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Stamp Collection App

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STAMP COLLECTION APP

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Abstract

The goal of this project was to assess the viability of a mobile device application to display the stamp collection of the British Postal Museum and Archive (BPMA), making it accessible to online and onsite visitors of the new museum. We conducted research about technology uses in museums, and developed a prototype based on audience interest in stamp history and design. We concluded that successful museum apps have a novelty factor, varied content that adds to the exhibit, and flexible technology with a high level of interactivity.

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Executive Summary

The mission of the British Postal Museum & Archive (BPMA) is to make the history of the British postal service, and its essential role in the advancement of communication, available to the public for research and enjoyment. In order to accomplish this mission by providing access to much of their collection, the BPMA is currently in the process of developing a postal history museum, the Calthorpe House New Centre. However, this museum will be relatively small and will not be able to house every item of the collection, which consists of pillar-boxes, mail coaches, articles of clothing, and the extensive stamp collection. Because of these display limitations, the BPMA is looking into using digital technologies to enhance availability of their collection and provide a more interactive and enjoyable experience for visitors. One option in particular that they are exploring is the display of the stamp collection using a mobile application.

The primary purpose of this IQP was to assess the content and viability of a mobile application that would effectively display the extensive stamp collection of the BPMA in a manner that appeals to the target audiences of the New Centre. To achieve this, we created and completed five objectives: characterize best practices in digital technology in museum exhibits, determine the interests of the target BPMA audiences, clarify the goals of the museum and identify criteria for the content and development of the app, design and evaluate a prototype app based on said criteria, and recommend steps for the BPMA to take towards the future development of the mobile application.

To analyze the best practices of digital technology in museums, we visited museums in both the United States and United Kingdom where we interviewed staff members involved in the development and evaluation of mobile applications, and developed our own criteria to evaluate the different digital technologies offered in museum exhibits. We assessed the interests of the targeted BPMA audiences, in this case general museumgoers including families with children, students, and independent adults. This assessment included analyzing previous market research and surveying the visitors of a BPMA event and the online audiences to determine how comfortable the audiences are with digital technology, what would motivate them to use the app, what content they would be interested in, and how receptive they would be to having the stamp collection displayed digitally. A majority of the current BPMA audiences are stamp collectors

and philatelists, so contacted these audiences to better comprehend their different interests and motivations. This information, along with the market research, gave us the necessary insight to be able to consider the interests of philatelists even though they were not the primary target audience. Based on this research as well as weekly meetings with the staff of the BPMA, we were able to create a set of criteria for the design and development of content for the app. We created a mock-up prototype of the app that a focus group of target audiences and the BPMA staff evaluated. Features of the successful apps we evaluated and the interests of target audiences served as the foundation for the recommended mobile application displaying the stamp collection of the BPMA.

During our museum visits, we evaluated seven apps and sixteen other digital technologies from nine different museums in the United States and United Kingdom. From these evaluations, we discovered what features make these technologies successful in carrying out the goals of the many museums, to appeal to a variety of audiences in an engaging and thought provoking manner. Mobile applications and other digital technologies are different in that while the apps can contain larger amounts of information, the digital experiences appeal to wider audiences and are available to more people especially in group settings. We ascertained several key qualities of successful apps that from our evaluations. Mobile applications with intuitive interfaces that are not intrusive to the experience and are more automatic in nature are often more successful. The app should not be an obstacle to people understanding the exhibit's objects or material the museum wishes to present. The focus should not be on the app as much as it should be on the exhibit. By reducing the amount of information given, visitors can pursue the information they are interested in, thus limiting the amount of time spent on the app and increasing interaction in the exhibit. Apps should not contain the same information presented in the exhibit space; they should expand on or present new information to the visitors. Finally, the usability of the museum technology affects how much information once receives, if the technology does not work then the visitor will not receive a complete experience. These museum findings helped to develop a process for app development: necessary resources, content and design, and considerations after release.

A museum should research and consider the necessary resources before making the decision to develop a mobile application. This investment is time consuming, taking 1-2 years from conception of concept to app release, and can cost between £30-70 thousand. The app

should reflect the mission of the museum, and the museum should determine if the app would aid in accomplishing their goals before making the investment. Additionally, museums should consider the social mechanics of the gallery, what is going to be of interest in the museum and interactive as well as how a mobile application will connect to the exhibit, when incorporating a mobile application into this space so that the app does not detract from the museum. Finally, from our evaluations into onsite and offsite digital technologies in museums, we determined that onsite apps were more successful.

From surveys of current and expected audiences, as well as previous marketing research conducted by the BPMA, we were able to form the content and design of the app. The current visitors to the Royal Mail Archive, Museum Store, and BPMA events are over 55 years old, most of whom are hobbyists interested in postal history, philately, and family history. However, this does not necessarily indicate the visitors that will visit the new museum as many of the current visits focus on the archive materials. Additionally, this audience may not be interested in using a mobile device, as of those surveyed as age increased the likelihood of the participant being a stamp collector increased while the likelihood of them owning a mobile device decreased. The expected audiences of the BPMA's New Centre, and the target audiences of this app, are families with children, students, and independent adults. These visitors will expect a fun, engaging learning experience from the museum. From the audiences surveyed, a majority of stamp collectors and non-collectors alike were most interested in the history and design of stamps for the content, with stamp collectors also being very interested in printing history and graphic design whereas the non-collectors did not express much interest. The information gathered on content is not limited to app use only; the BPMA can use the survey results for future development of the website or other technologies to display their stamp collection. In regards to app features, the onsite audiences were most interested in the app if it was entirely free and included artwork, with the next highest result being that they would not download the app. For the offsite audiences that took the online survey, most were interested if all or some of the content was free, it included artwork, you could virtually collect stamps, it were used in the museum, and it included general information about the BPMA.

There are several additional concerns after the release of the app that museums should consider before app development. Many mobile apps become obsolete in a short time frame. The BPMA should consider that most apps have a lifespan of one or two years. The ability to update

the app will directly determine the length of its lifecycle. The app needs to be flexible enough so that the BPMA has the option to add new stamps continuously and change or remove any content necessary after development. Not only does the app require up to date content, but it must also keep up with software updates specific to the device.

Using these findings, we developed recommendations for the BPMA in the form of a mobile application prototype. This app addresses the previously mentioned qualifications of motivation, engagement, usability and content that define the success of digital technology in museums. The concept for the BPMA's app is virtual stamp collecting, using image recognition software to identify chosen stamps in the museum exhibit space available for collection. For each collected stamp, the app displays a variety of information including stamp history, social context, design information, and rarity, and provides links to related stamps. The source of motivation is the new technology, piquing visitors' interests as a novel way to present the archived information. It engages the user with diverse content to keep the visitor interested and with the interactive process of virtually collecting stamps around the museum. The app will be available on users' personal mobile devices so that the app does not detract from the interactivity of the museum. Thus, the app remains usable only if the technology works properly across multiple platforms, as it would not be available to all visitors otherwise. The application could later offer the possibility of taking pictures of any stamp and adding it to your collection, providing a greater draw for philatelists or young stamp collectors that would like a virtual database of their collections. Only some content in the app should be free, including the picture of the stamp, basic information, and a small piece of trivia, while users can access the rest of the information either by visiting the museum and collecting the stamps or by paying a small fee to unlock the content. The content included in the app is history, design, images and fun facts for each stamp. In order to make this app successful, the museum gallery should facilitate the use of the app. It is important that the museum gallery provide Wi-Fi. The museum is also responsible for advertising the app onsite and online to ensure that the audiences are aware of this technology before and during their visit to the museum. Finally, there should be photographs of various stamps scattered across the museum's different zones to facilitate the stamp collecting.

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Growth and Assessment of Digital Technologies in Museums	Jose Meneses & Brendan Stephen
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Objective 2: Determine the Interests and Needs of Key BPMA Audiences	Taylor Manning
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Introduction

Museums typically have three roles: to maintain collections, conduct research, and to educate. In order to educate their audiences they use engaging exhibits and programs. In recent years, museums started incorporating digital technology directly in exhibits to enhance the visitor experience. Many museums are now developing and using mobile applications to enable visitors to access interpretive information from mobile devices before, during, and after their visit. According to a recent survey polling over 600 museums worldwide, 29% of museums currently use mobile applications in their exhibits and 27% plan to use this form of presentation in the future (Tallon, 2012).

However, many questions remain regarding the effectiveness of technology in a museum setting. Each museum setting is different; therefore, each use of digital technology should meet a particular need and setting. Given the rapidly evolving nature of this technology, and the absence of clearly defined best practices, the development of a mobile application especially can be costly and presents a substantial risk of failure. This poses a problem for both the technology and the users alike. User interests change just as quickly as the technologies themselves. This has left many museum professionals to consider if implementing recent technologies could improve the visitor experience in their galleries.

The British Postal Museum & Archive (BPMA) is opening a new museum facility in the near future; this New Centre will provide the space that the museum needs to exhibit their collections, and make postal history available and appealing to their different audiences. The BPMA is interested in creating a mobile app to allow access to their sizeable stamp collection in this New Centre, as the location in London will not have enough gallery space to display all of their collections from both the Royal Mail Archive and the Museum Store. The goal of the proposed project is to assess the viability of the app and the role it would have in the BPMA. In order to do so, the project team:

1. Characterized the state of the art or best practices in the use of apps in museums.
2. Determined the interests and needs of key BPMA audiences.

3. Clarified the goals and expectations of the British Postal Museum and Archive (BPMA), and identified a set of criteria for the content and development of the app for their stamp collection.
4. Designed, developed, and evaluated the prototype app based on content and design criteria.
5. Recommended steps for the BPMA to take towards further professional development of the app.

We conducted research in order to make a reasonable recommendation for the BPMA to refer to when further developing a mobile device app for their stamp collection. To create a list of best practices of mobile technology in the museum industry, we visited museums in both the United States and United Kingdom to interview staff and assess different ways that museums use interactive digital technologies in exhibits. We contacted the key audiences of the BPMA through surveys and interviews in order to determine what their expectations for the app were and how analyze the reception of the app. We also interviewed BPMA staff to clarify their expectations for this project as well as the possible content of the app.

It was possible to create a set of criteria for the design and development of the app from further analysis of related literature. From this information, we created a prototype of the app. This was an iterative process; the BPMA staff and target audiences evaluated the prototype and we adjusted it accordingly before final recommendations. The research and prototype evaluations served as the basis for the recommendations on the effectiveness of a stamp collection app, content features, and potential designs for it. With these recommendations, the BPMA will be able to make well-informed decisions when further developing a stamp collection app. Ideally the BPMA will be able to develop the app and use it to make their stamp collection accessible and appealing to many of their audiences.

Literature Review

Background

The British Postal Museum and Archive (BPMA) dedicates itself to making British postal history available to the public in a way that a majority of their audiences can find interesting and relevant. They are in the process of building the Calthorpe House New Centre, which will provide a way to exhibit the museum's diverse collections, something that is not possible with the current facilities. To display the large stamp collection will not be possible through traditional means since the exhibit space is not large enough, so the BPMA is considering developing digital technology in their exhibit space to make their stamp collection available to the public. This literature review describes the following aspects of incorporating both learning and technology in museums, and how they are significant considerations in museum development:

1. *Evolution of Approaches to Education in Museums* – explains the different learning approaches in museums as categorized by George Hein, how museums implement these approaches, and any problems with implementation.
2. *Growth and Assessment of Digital Technologies in Museums* – describes the onsite and online digital technologies incorporated in museum exhibits and how this technology affects learning in museums. Additionally, it explains how information in museums is changing from only existing in the exhibit space to mobile and online experiences, and how this affects both museums and museumgoers.
3. *Technology in the British Postal Museum & Archive* – depicts the aims of the BPMA, and the manner in which the museum can achieve these aims by using digital technology in their New Centre.

Evolution of Approaches to Education in Museums

Museums are important institutions for teaching and learning, and as such, they strive to display their collections in a manner that encourages engagement and education. While

education has been an implicit goal of museums for a long time, the 1946 ICOM definition of museums does not explicitly reference this (Hein, 2006). Since this time, museums have focused increasingly on their educational role in society and many emphasize education as a major part of the organizational mission. As defined by the International Council of Museums (ICOM) in 2007, "A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates, and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment" ("Museum Definition", 2013).

Museums achieve their educational goals through exhibits, programs, and various outreach activities, each of which revolves around particular collections, but the educational approaches adopted by museums have changed substantially over time. As George Hein discussed in his 1998 book *Learning in the Museum*, different theories of learning and theories of knowledge support these educational approaches (Hein, 1998). The theories of learning fall within a range from "passive" to "active" (Figure 1). On the passive side of the spectrum, the mind is viewed as a "vessel to be filled" by information. Thus, information that is broken down and arranged into easily assimilated pieces enhances learning. On the active side, the person learning plays an active role in the process by making sense of and thinking about the information presented to them while relating that information to their previous knowledge. Instead of focusing on what an individual learns, the focus is instead on what the museum contributes to that existing knowledge (Tallon & Walker, 2008). Museums that emphasize active learning pay more attention to the needs of the learner and the most effective way to present information to visitors so that they can process it more easily and effectively. According to Hein (Figure 1), theories of knowledge range from notions that knowledge is 'independent' and sits 'out there' as a set of facts to be acquired, to notions that knowledge is constructed by the learner in the way that they choose to interpret it (Hein, 1998). Hein created four domains of educational methods from these theories of learning and knowledge (Figure 1).

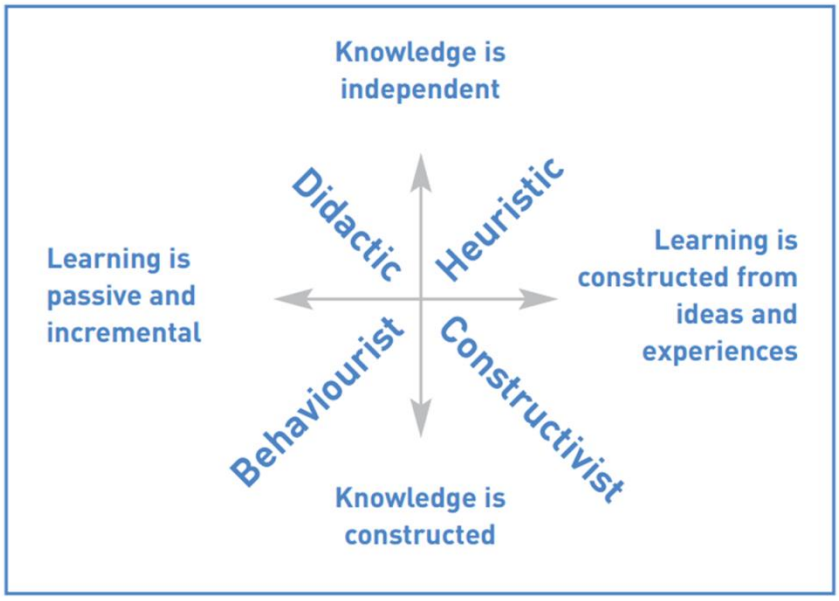

Figure 1: Hein's Educational Categories (Hawkey, 2004)

Didactic educational methods have been dominant in museums in the past, but many museums, especially science museums, have experimented with other approaches to learning in recent years. Museums that emphasize passive learning methods, specifically the didactic and behaviorist approaches, contain exhibits that are sequential in structure with a clear beginning and end as well as components such as labels and panels that describe what is essential for the viewers to learn. In museums that emphasize active learning methods such as heuristic and constructivist approaches, visitors are encouraged to learn through experimentation in exhibits that are interactive and "hands-on". Generally, in didactic and heuristic museums where the knowledge presented is a set of 'unquestionable' and 'independent' facts, the museum staff deems one interpretation of the subject matter in the exhibit as the "correct" interpretation. This is not always the case, as some conventional museums make viewers aware of several different interpretations of known facts. However, these museums rarely encourage visitors to develop their own conclusions about the material.

In behaviorist and constructivist approaches, which aim to facilitate the construction of knowledge, a wide range of perspectives on the topic are 'allowed' and visitors are encouraged

to establish their own interpretations based on their previous experiences and prior knowledge. These interpretations by visitors are 'correct' unless they are completely unrelated to the subject; they are all part of the learning experience (Hein, 1998). However, as Tallon and Walker discussed in the 2008 book *Digital Technologies and the Museum Experience: Handheld Guides and Other Media*, this concept often causes conflict in museums because of their roles as "authoritative cultural institutions." In giving visitors the power to create their own interpretations and meaning from an exhibit, the museum loses authority (Tallon & Walker, 2008). As the BPMA is a postal history museum and archive, the range of interpretations made when viewing the exhibits might be more constrained than in many other types of museums. According to Tallon & Walker, allowing visitors to create their own interpretations in this case would not be beneficial to the museum or museumgoers as the intended message of the exhibit might not reach the audiences. Alternatively, while visitors may not interpret the exhibits differently than curators and museum staff, each visitor could create a different meaning from the experience, which is something to consider when incorporating different learning approaches.

The museum world has utilized the didactic theory as a primary learning method for many years. Typically, museums adopting such approaches would display artifacts from their collections in static exhibits, often mounted in glass cases or behind physical barriers. Museumgoers were discouraged from touching or interacting with the artifacts and instead interpretive text panels, labels, and staff members told them what they 'should' learn from the exhibit. This perception remains regarding many museums, even the BPMA. In focus groups with parents, many indicated that, "they may be scared to bring young children to the BPMA in case they broke the artifacts," (Richmond, 2013). A number of museums, especially science museums, have shifted towards more constructivist approaches that allow visitors to interact with the exhibits and make their own meaning of the museum experience (Fritsch, 2007). Of course, this shift is a gradual process. Many museums are struggling with ways to make their collections more accessible and interactive, and most museums contain exhibits that reflect different educational theories (Fritsch, 2007). In fact, several museums successfully combine several of the learning approaches in their exhibits. To appeal to different types of audiences such as families with young children, the BPMA's New Centre will need to remain an educational

facility while simultaneously turning away from the traditional didactic methods and incorporating other approaches as many other museums have been doing.

If visitors can become involved in the learning at museums through experimentation and development of ideas, they are likely to become more engaged in the exhibit. Unless visitors have an extensive knowledge of the material, it is likely that they enter the museum without a specific goal other than to learn (Tallon & Walker, 2008). It is the responsibility of the museum to provide a setting conducive to active learning and the creation of personal meaning. A primary purpose of museums is education of the public and engaging visitors without simply telling them what to learn is one effective way to help visitors get more out of their museum experience. As Hein stated, "Learning in a museum should no longer be thought of as a straightforward model of 'transmission' of fact, but rather as a construction of knowledge made by the visitor during the visit within a framework of prior knowledge and assumptions that the individual already carries in their mind and brings with them to visit" (Hein, 1998). This is a fundamental change from the traditional didactic approach still used in many museums, as some are attempting the gradual shift towards greater use of interactive exhibits and displays, particularly ones utilizing technology.

Growth and Assessment of Digital Technologies in Museums

Current expectations for museums have driven them to look for more interactive and effective methods to portray information. Digital technology has become a popular alternative among such institutions since it has an immense potential for providing interactive experience in a learning environment. This has led to the introduction of digital applications to both onsite and online resources at museums. The use of technological tools online has changed the interaction between the museums and their audiences. Museums use their websites to display digital exhibits, to connect to social media and to provide interactive tools. The use of technology onsite has enhanced the portrayal of artifacts in galleries and has provided diverse hands-on experiences. For many museums, the question is, "Should effort and money be spent primarily on the visitors who will enter the walls of the institution or those who will virtually explore the site through the web?" (Hawkey, 2004). This is a delicate decision to make, since many of these

projects require a significant quantity of resources and proper implementation. Although it would be optimal to create the most effective on-site and online experiences for the visitors, it is more practical to analyze the alternate media used and choose the most feasible for the museum. Figure 2 shows the many roles of digital technologies in on-site and online learning opportunities. Hawkey proposed the chart in Figure 2 as an example for the organizational structure of digital technology experiences offered by museums. The two main categories are on-site and online, which divide into subcategories that specify the type of technological experience.

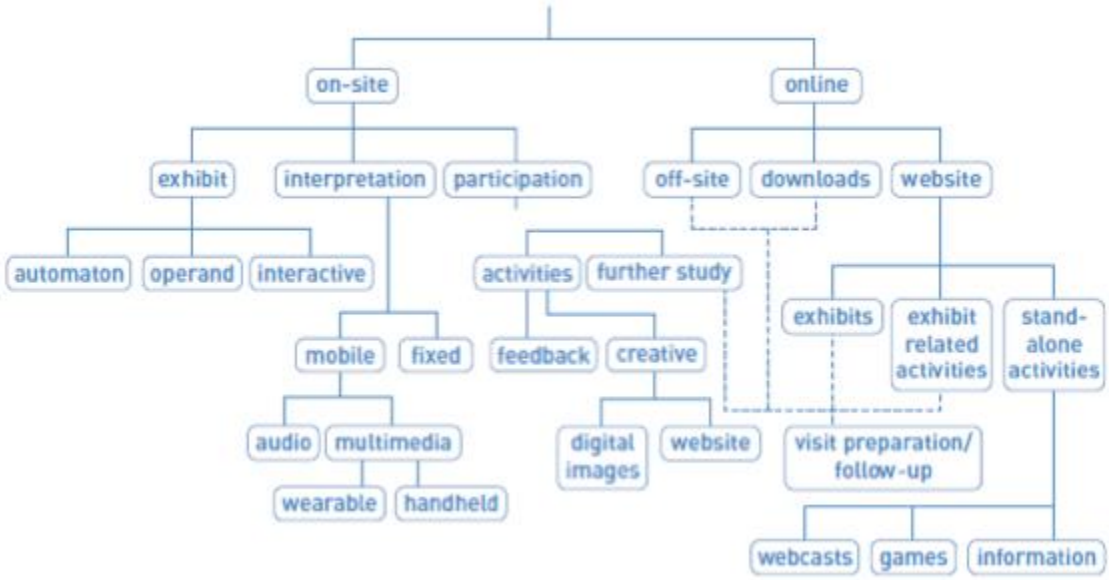

Figure 2: On-site and online digital technology experiences (Hawkey, 2004)

The integration of digital technologies into galleries can enhance exhibitions and visitor experience in museums. The traditional museum exhibit displays its collections in their establishment for the visitors to see. This structure is no longer sufficient to educate and entertain certain visitors. Museums are looking for alternatives to increase interactivity and engagement. A factor that contributes to the increased use of technology in museum galleries is the idea that "learning, while worthy, is essentially dull" (Hawkey, 2004). The introduction of technology in museum space attempts to reduce the dullness in learning by making learning interactive. It also helps with "learning from objects rather than simply learning about them" (Hawkey, 2004). Technology creates the possibility of interacting with objects, which enhances the visitor's learning experience. The BPMA is likely to focus on virtual interactivity, since stamps are

delicate objects and they need special care when handled. An excellent option to help museums to provide a more "immersive and interactive [experience]" for visitors, is engaging them in activities that stimulate both their physical and mental senses through technological means (Pallud & Monod, 2010). For instance, the Powerhouse Museum in Australia installed multiple iPads in one of their exhibits, which allow the user to simulate the tasks associated with managing an urban water system (Bean, 2012). These iPads create an interactive learning experience and allow the users to simulate some of the artifacts in the museum.

Many museums offer different types of guided tours. Traditional audio-guided tours have been and are still a popular tool for interpreting museum exhibits and enhancing visitor experience. Audio tours typically provide expert interpretation of the artifacts displayed in a structured fashion that is didactic in style. The visitor can choose to listen to information about artifacts that seem interesting or skip segments; nevertheless, the overall learning experience is linear and lacks interactivity. Although, audio tours were successful for many years, lately, they are beginning to evolve in order to satisfy the public. The traditional structure of audio tours is not ideal for a generation habituated to the variety offered on the internet. Many audio tours are very rigid and do not give the user freedom to choose what information to receive. This has led to the development of more customized tours. Some of the options offered at museums include podcasts and downloadable files. Even though these alternatives are similar to standard audio tours, they give visitors the ability to choose what content to view and the device to present the content.

There are newer technologies that offer an even greater variety of media. For instance, the Louvre has created a new model for tours that adds additional features to the traditional audio-guided tours. They offer visitors their own personal Nintendo 3DS as a guide to their collections (Bean, 2012). The Nintendo 3DS immerses the user into a game like environment, which allows for an entertaining museum experience. This app offers Wi-Fi enabled media, which appeals to the majority of young visitors (Proctor, 2011). Museums should aim to implement these new technologies correctly; otherwise, the objects may become secondary to the message (Hawkeye, 2004). The technology should enhance the transmission of information and

not replace the artifacts. Museums want to be a source of education; therefore, technological additions should not interfere with this goal.

Mobile apps can be both offsite and onsite additions to museums. This versatility is a unique trait that makes mobile technology popular. The capability of mobiles to reach people from any location expands the power to transmit the museum's information. This ability is useful since "the museum can not only enter people's homes and classrooms, but can also be part of their daily commutes, their international travel, their work and leisure activities as never before"(Proctor, 2011). Figure 3 shows the intersections among learning, digital technologies and museum and galleries. A mobile app is capable of influencing each one of these areas. The generation of mobile apps is changing the way museums can offer their information and their ability to make it reach the audience.

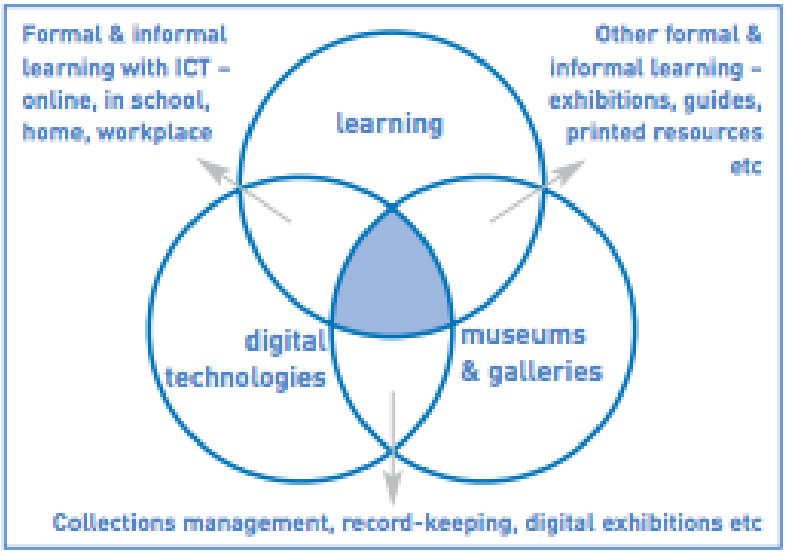

Figure 3: Learning, Galleries, and Technology (Hawkey, 2004)

Ways of presenting information are changing. The internet, as a global infrastructure of connected networks, offers anyone who is connected, access to an abundance of information. Access to this information is increasingly easier with smartphones and software tools such as Google. Anyone with access to the internet can find information on an abundance of topics quickly and easily. Young people especially use this quick access to connect with friends on

social networking websites, their phones, and any other internet enabled device. This type of interaction with media and information is different from other modes of information consumption. This different form of presentation has not only changed the format of the information, but also an individual's expectation about what information he should get. One is more inclined to learn about something on the internet because of how easy it is to find information. In this sense, museums should provide information to visitors that facilitate content generation instead of content consumption. "Museums need to move from being suppliers of information to facilitators, providing tools for visitors to explore their own ideas and reach their own conclusions. This is because [of their] increasing access to technologies, such as the Internet" (Kelly, 2006). If museums do not, there exists a risk that visitors will already know the information presented at exhibitions and not learn as much. Museums can contribute and add to the content already available instead of supplying information as a means to reach visitors who already know a great deal.

The public's current views of museums offer insight into how these institutions can proceed. The common perception is that museums are a trustworthy source of information over other sources. The large amount of planning and research put into making a museum exhibition fosters a public image that museums provide accurate and dependable information. "The American Association of Museums commissioned a survey of Americans' views about sources of trustworthy information, comparing museums with a range of other sources. This survey found that there was a low level of trust in the news media, with the majority not trusting it" (Kelly, 2006). While news media offers new information and stories that just happened, public trust appears to be strongest with information found at museums because in contrast to news media, museums offer objects and collections to strengthen their researched information.

Conveying this information to many different audiences in the past has often remained inside an exhibit space in the museum itself. However, just as the presentation of information is changing, museums are changing how they distribute content to its audiences. "The way forward will surely not be in the printed exhibition catalogue selling to 5% of audiences, or the Web site resembling a kinetic brochure, but in live, streaming, downloadable, and open-ended resources," (Marty and Jones, 2008). This type of content is for not only use in exhibits or in object

interpretation, but also for outside the museum in a pre-visit, post-visit, or even research environment. A museum's audience then can expand from an on-site exhibit or gallery to anyone that can connect to the internet. Technology allows for the information at museums to be accurate and accessible on a larger scale than before. An immersive learning environment is not limited to the museum itself with technology.

Big data in combination with mobile experiences can help museums to present information outside of the exhibit space. One aspect of big data is the notion that there exists an abundance of unfiltered user-generated content on the internet growing at an ever-increasing rate. Facebook is an example of big data architecture, as its entire domain of content is user generated and will continue to grow as long as people use its services. On Facebook, one can post his or her first person experience of an event that just transpired and share it with anyone anywhere. Shareable information includes but is not limited to comments, photos, messages to other users, and even one's location and interests. Museums can use this form of content sharing as well in order to put more information into visitors' hands. One can access this shared content anywhere if he uses a mobile device. Many museums now offer this with mobile applications or apps.

Apps can utilize user created content and present new ideas to both museums and museumgoers. Collaborating with visitors allows the institutions "To consult with experts or community representatives to ensure the accuracy and authenticity of new exhibitions, programs, or publications" as well as "To provide educational opportunities to design, create, and produce their own content or research" (Simon, 2010). A museum utilizing the same constructivist framework for its mobile technologies can tap into the communal knowledge and big data of the internet to strengthen the content of its own collections. This can be both positive and negative for museum exhibits however. If museums give more power to the museumgoers to generate their own content, museums may degrade their public image. Visitor access to unregulated content threatens the museum's authority over content and public image, as previously mentioned. In the case of the BPMA, user comments about stamps may be incorrect and the integrity of the information presented as a whole comes in question. There is a risk that the

information a museum provides and the user created content will contradict. In this way, a museum's credibility can degrade and its authority of its own information can weaken.

There exists an opportunity to improve the message of an exhibit as well with user generated content. If a museum facilitates collaboration between identifiable experts, user generated content can be a benefit to museums. An expert on philately that the BPMA credits for adding to its collection in the past, for example, from the United States can make comments on the stamp collection with a mobile application. He is knowledgeable on the subject of philately and can validate information the museum already has as well as offering up new information to museum curators, all without going to the museum. With the information offered from users, museums may pursue further research on the subject to generate new information. If the comments do not immediately penetrate visitor access, museums may use them to be aware of information they can add to their exhibits in the future. Based on Simon's argument, it is clear that the external influence of a constructivist learning style promotes new educational opportunities and presents new information, but only if well regulated.

QRator is one app in particular that does this. This app is an example of how big data and sharable user content intersect with the physical objects in a museum experience. "QRator allows visitors to type in their thoughts and interpretations of museum objects and click 'send'. Their interpretation becomes part of the object's history and ultimately the display itself via the interactive label system to allow the display of comments and information directly next to the artifacts" (QRator, 2013). The use of technology can present more information to museumgoers than labels and displays simply because content can change on a screen and not on a static label or poster.

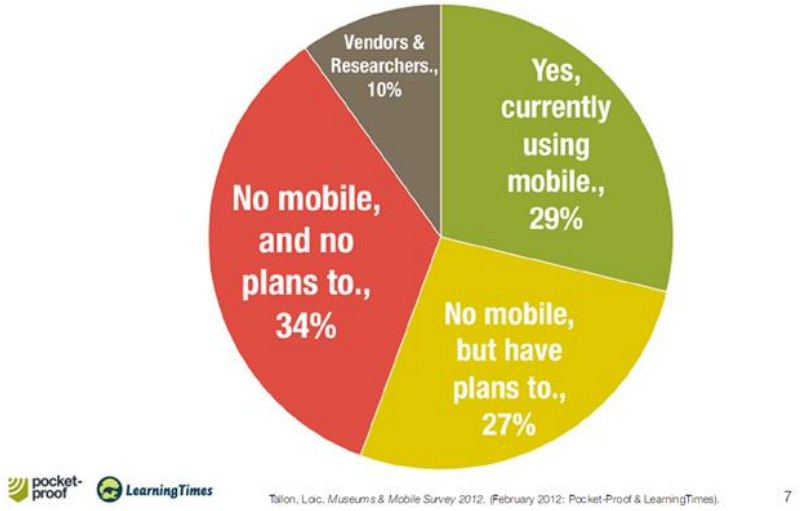

Figure 4: Percentage of museums that currently offer mobile experiences (Tallon, 2012)

The percentages in Figure 4 display how many museums are looking to develop mobile technology. Only 29% currently use mobile technology, but another 27% have plans to offer mobile experiences in the future. This statistic shows that about a quarter of museums in general are making plans to develop mobile experiences. This does not mean however that every mobile experience is the same. Presentation of information on mobile devices differs as other modes of presentation. In this manner, some mobile experiences are better than others are and may impart a greater level of learning. Figure 4 shows that the percentage of museums that do not have mobile nor have no plans to is 34%. One reason for this high number is that some implementations of big data and user-generated content for mobile did not fulfill their aims. Looking at some previous evaluations of mobile experiences can offer insight into whether or not a museum should develop an app or other mobile experience.

Personalization, a process that identifies content that is user generated or "personalized" in a museum space, is one notion that, if presented poorly, can have negative effects on the museum experience. For example, when walking through the Darwin Center of the Natural History Museum in London, one has the opportunity to pick up something that most museums do not have: a swipe card. A swipe card allows a museumgoer to pick out objects in the exhibit space they want to find more information on and "scan" the object to the card. Then, at another location outside of the museum, he can learn more about the objects "scanned" on the internet.

The problem exists because visitors are unaware why they should take a swipe card and never given direction to take one. This means the visitors must, on their own, figure out how to use the swipe cards and intrinsically figure out the possibilities of personalization. "The concept of personalization proved to be a difficult concept to grasp and respondents struggled to see what it might mean. Even when the idea of having a swipe Card or other method of identifying themselves as they went around was explained, they still struggled to see what it would offer them or why they would want to use it" (Creative Research Ltd., 2007). Whenever a visitor must figure out how to do something, the task is usually unsuccessful, and personalization is no different.

Experiences online that display the "scanned" items or other museum objects also struggle with how to create an accurate representation of the artifacts. Mobile applications and online experiences just in their nature separate the museumgoer from the collection items themselves. The technology should improve the ability to transmit information and not distract from the purpose of the exhibits or collections. Stogner presents the argument that the online collections of artifacts "do not yet provide a sense of scale or texture of the original objects" (Stogner, 2009). This difficulty often limits the type of information presented online and on mobile devices. The information on mobile devices and the information in the museum require a symbiotic relation where each complements the other. A goal for the use of technology then is to have the objects motivate someone to go online to learn more, as well as an online experience that stimulates a museumgoer's interest in the object.

The people interested in this type of museum experience are also part of a specific audience. "The students and teachers could see that personalization could be of real value for students on an educational visit especially if this linked in with school project work or with the school curriculum. However, if they were visiting outside of school, either by themselves of with family or friends, they were no more likely to want to take advantage of what it offers than anyone else" (Creative Research Ltd., 2006). Currently, the concept of a personalized or a personally unique museum experience appears to be too foreign for everyone going to a museum to gain something valuable from it. Perhaps better instructions or awareness of how to use a

personalized experience or what to do at a museum visit with a personalized experience would offer more insight.

There is certainly much to gain from a personalized experience as it can offer insight into specifically the museumgoer's interests. One museumgoer can have a different experience at the museum than another who went through the same exhibit simply because they only interacted with what interested them the most. This specialized museum approach offers students a much more valuable visit as well. One is much more likely to stay at an object or space in the exhibit longer if he invests himself in the object. This allows for a much more immersive experience where one can internalize the content presented. Thus, a personalized museum fosters learning and schools and project work will greatly benefit from it. How much personalization will affect other audiences attending the museum is still unclear however. Some audiences may be more receptive to this museum experience than others may. "There did appear to be something of an age effect with teenagers and younger adults often finding the concept more appealing than older adults." Another aspect of personalization is its ability to target younger audiences and a museum may use it to attract them.

Targeting specific audiences is important to museums; however, expanding audiences can be just as important. Museums often have many target audiences including new audiences that do not currently attend the museum. Technology is becoming a valuable tool for attracting these audiences. "Online cultural heritage documentation (in environments like the Web) offers the opportunity for museums to reach beyond their traditional local-service area, to provide service to a dispersed community of specialists and enthusiasts," (Marty and Jones, 2008). There is currently no best practice to do this, however, as museums have different views and audiences to contact. Some may use an app to reach a target audience for its link to big data, and others may not. While an app can target specific audiences, it is not appropriate for all audiences. Some audiences may not have cell phones or tablets for instance. Others may not be motivated to download the app, be engaged in the content, or even not know how to download an app for what purpose. "Research suggests that while your existing audiences may download an app, those who are not already attending your exhibitions, productions or events are far more likely to end up on

your website" (Richardson, 2012). To reach the largest of audiences, a museum must use the most widely used technology among all audiences.

Looking to market research of internet-enabled devices offers much insight for museums to discern properly how to present their information. A recent eMarketer report from October of 2012 notes that 67% of the population uses a laptop in the UK and only 36% of the population uses a smartphone (eMarker, 2013). This suggests that an alternative to an app may be best to reach the largest audiences of internet users. Museums perhaps should consider an interface standard that is agile enough to work well across all internet-enabled devices to reach an even wider audience, like their website. "Responsive website design is now the industry standard and any cultural organization looking at redeveloping their website should demand a solution that will work across devices ranging from large desktop computer monitors down to the smallest smart-phone" (Richardson, 2012).

The choice to present information with an app, a mobile optimized website, or both is one made by many organizations. Market trends and cultural perceptions of how an average person would complete a specific task often dictate which option to select. For example, a new visitor to a museum may want to look for directions or generic information about the museum before going. In this case, a mobile optimized website would best suit the user especially if they are currently traveling to the museum. As for the regular museumgoer or specialist on an exhibit at the museum, they would require more in depth content that is not present in the exhibit space. This case would often see the development of a mobile app. The audience generally wants to know more about the exhibit, and less about the museum as a whole. The perceived notion is that an app offers more information than what is on the museum website. In this sense, a museum's decision between developing a mobile app or a mobile optimized website is dependent heavily on the user.

Current internet users in the UK have been changing the way that they access content however. Mobile experiences have been on the rise in the UK, especially in mobile advertising, as the UK is currently the world leader in amount of money spent on mobile advertising. According to an eMarketer prediction, the UK will have mobile device users hit 63% by 2016

(eMarketer, 2013). The year 2016 is when the BPMA wishes to release its app and the opening of its new museum, so there must consideration of future market trends. With the increase of mobile device adoption in the UK, it is clear that mobile devices will rival laptop usage. A dynamic website may not make sense, or app usage may change by 2016 according to this data. Understanding users and their interests in technology drives content distribution.

Another consideration for a museum is whether an app should be an on-site or off-site mobile experience. Specifically, where the target audience resides in relation to the museum is significant. There appears to be a correlation between large audiences and off-site purposed apps. Normally, the largest audience for a museum is the off-site audience because they can download mobile apps to get content, whereas this is not always necessary for an audience that attends the museum. Apps developed for on-site purposes generally are for use in the exhibits themselves. For example, the i-Tour app for iPad at the London Film Museum, shown in Table 1, scans QR codes at the museum exhibit itself and provides further information, photos, and videos for the museumgoer. Table 1 offers basic information about a variety of apps. The BPMA and our group chose these apps as ones of interest to the project because museums developed them. Smaller museums or those interested in reaching new people develop off-site apps more often which matches information from Tallon's Museums and Mobile Survey. Museums rated as "Very Important" for their mobile technology plans to have off-site experiences that "raise the profile of the institution with new audiences" and "attract new visitors to the institution". As an archive, the BPMA does not allow the public to access all of its archived information, so they have an interest in the apps in Table 1 to connect new audiences to this information.

App Name	Who Developed it?	Devices Available	Cost	Short Description	Audience Type	On-Site?
i-Tour	London Film Museum	iOS (iPad native)	Free	Provides the visitor with information, pictures, clips, and games on the iPad screen when held on one of the QR codes around the exhibit.	People who attend the London Film Museum.	On-Site
ByteLight	Boston Science Museum	iOS (iPad native)	Free for uses in museum	Walk around the museum exhibit and the app would change when you approached different spaces. The lights in the ceiling interacted with the camera on the iPad and it would trigger the iPad to change the content displayed.	People who attend the Boston Science Museum.	On-Site
James May Science Stories	London Science Museum	Android, iOS	3.2	Scans a Science Museum display and places a 3-D avatar of James May onto the display to speak to you and provide more information about the object	People who attend the London Science Museum for the Transportation exhibit, or those at home who would like to learn about the content in that exhibit	On and Off-Site
Art Hunter	National Galleries of Scotland	Android, iOS	Free	Allows one to collect different pieces of art around a few different museums and galleries. Once collected, one has the option to get more content about the art including trivia, audio descriptions, and links to other relevant pieces with a layered information interface	People who attend the National Galleries of Scotland.	On-Site
QRator	Grant Museum of Zoology	iOS (iPad native)	Free for users in museum	Similar to a kiosk in a museum, this stationary, on-site app is a conversation starter for sensitive topics linked to the museum objects. Along with the on-site experience, there is a website where the conversation can continue (not many use this, if any). The app itself is not for personal download.	People who attend the Grant Muesum of Zoology.	On-Site
V&A Audio Tour	Victoria & Albert Museum	iOS	Free	Mostly used for audio tours and some additional information in the Mideval section of the V&A.	People who attend the Victoria & Albert Museum	On-Site
SCVNGR	London Science Museum	Android, iOS	Free	Allows one to check into different locations and perform certain tasks to gain badges. Can create own task or journey to complete and share with friends on the app.	People who attend the London Science Museum and would like to scavange around the museum.	On and Off-Site
Vusiem	London Natural History Museum	Android (free), iOS (paid)	Free	Basically a virtual exhibit with some interactive content (mainly ratings of the app itself and sharing the app itself with friends).	People who attend the London Natural History Museum and those who would like to learn more about mammals.	On and Off-Site

Table 1: List of museum apps with basic information

Technology in the British Postal Museum & Archive

Established in 2004, the British Postal Museum & Archive (BPMA) serves as the public identity for the Postal Heritage Trust, which provides access to collections from the previous National Postal Museum and administers the public records of the Royal Mail Archive ("Impact

Report", 2011). Today, the BPMA has managed to stay true to its mission to make the history of the British postal service, and its essential role in the advancement of communication, available for research and public enjoyment ("Impact Report", 2011). The BPMA is especially interested in developing its capabilities in and use of digital technologies for two reasons. First, the BPMA currently has very limited space for the physical display of artifacts from its collection, so offering virtual access to the collection through an array of new digital technologies is very attractive to staff and visitors. Second, the BPMA is in the process of building a new museum facility. However, because of the relatively small size of the new museum and the BPMA's sizeable collection consisting of items such as pillar-boxes, mail coaches, articles of clothing, and the substantial stamp collection, building a new museum will not solve all of the display problems. Thus, they would like to enhance availability to the collection as well as visitor interaction and satisfaction using digital technologies.

Over the past few years, the BPMA has been using social media to reach out to a greater variety of people and make its collection better known and accessible. The British Postal Museum & Archive began using social media in 2009. In 2011, they accrued 143,745 blog visits, 132,939 Flickr image views, 773 Facebook likes, and 1,973 Twitter followers ("Impact Report", 2011). The number of Facebook likes and Twitter followers have more than doubled since then. When the BPMA expanded to social media, they discovered that more people were interested in stamps than just philatelists and stamp collectors. Research conducted in 2011 revealed that a majority of the BPMA's social media audience is of working age, and evenly distributed between the ages of 25 and 74. Most were male (59%), white (60%), and from the United Kingdom (67%) (Bean, 2012). In addition to their social media outreach, in 2011 the BPMA also launched their website as a new interactive website intended to be more appealing to the public. This new site features a digital catalogue of most of the collection, an online shop, and an interactive and well-organized learning section focused on the extensive British Postal History. In the first year since its re-launching, 437,403 people visited the website, 73% of whom were new to the site ("Impact Report", 2011).

The British Postal Museum & Archive is researching the incorporation of digital resources into museum exhibits and displays for a number of reasons. At present, the BPMA has

three facilities: the Royal Mail Archive, the Museum Store, and the Museum of the Post Office in the Community ("About the Collections", 2013). With limited exhibit space, it is possible for the BPMA to display only a very small fraction of its extensive collection of postal artifacts dating back to the 1840s. Currently, the BPMA has much of their collection displayed through virtual means on their website, but ideally, they would like to have some representation at their museums. To work towards their goal of making as much of their collection available to the public as they can, the BPMA is building a museum at Calthorpe House set to open in 2016 that will include a large gallery displaying much of their collection, educational facilities for visiting schools, and an archive among other things (Bean, 2012). Even with a new building, the BPMA will still not be able to display their entire collection, which is where digital resources will become essential. By incorporating technological displays in the museum, it will become possible to display more of their collection than would be possible otherwise at the New Centre, while minimizing the use of gallery space for other exhibits.

In addition to saving space, the use of digital resources will also allow the BPMA to appeal to a wider audience. The museum aims to be able to attract and cater to new audiences at the New Centre, specifically striving to engage and hold the interest of children aged 3-16 years old as well as young adults (Bean, 2012). The BPMA has experience with this age group, as they are very involved with primary and secondary schools. They have worked on creating learning activities and school workshops for these children, as well as learning tools for teachers to use in the classroom, so the BPMA has a good understanding of exhibits and hands-on activities that appeal to this age group ("Exhibitions & Events", 2013). In 2009, a Jura Consultants conducted focus groups with family audiences to assess how to appeal to them specifically. One concern was that "postal history in itself is not particularly interesting; the excitement comes from how it is presented." Additionally, families were expecting a "fun, educational and sensory experience" at the BPMA (Richmond, 2013). One way to appeal to the younger generation in an entertaining way is using technology. By making exhibits more interactive and technology based, the important historical collections of the BPMA will become more accessible to a younger and digital generation.

Methodology

The overall objective of our IQP is to assess the content and viability of an app for the stamp collection of the British Postal Museum & Archive (BPMA). The BPMA is interested in showing a portion of their collection through an app in addition to inviting newer audiences to explore the history of stamps through innovative use of technology. In order to achieve this goal, we have identified five objectives.

1. Characterize the state of the art or best practices in the use of apps in museums.
2. Determine the interests and needs of key BPMA audiences.
3. Clarify the goals and expectations of the British Postal Museum and Archive (BPMA), and identify a set of criteria for the content and development of the app for their stamp collection.
4. Design, develop, and evaluate prototype app based on content and design criteria.
5. Recommend steps for the BPMA to take towards further professional development of the app.

Objective 1: Determine Best Practices

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1. Characterize the state of the art or best practices in the use of apps in museums.
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4. Design, develop, and evaluate prototype app based on content and design criteria.
5. Recommend steps for the BPMA to take towards further professional development of the app.

Objective 1: Determine Best Practices

Many museums have already incorporated mobile technology and digital technologies into their exhibits. Building on initial assessment of museum apps in the literature review (Table1), we contacted museums that have existing mobile apps or other digital resources, as well as museums that are currently working on acquiring mobile technology. We assessed the mobile and digital technologies themselves regarding their differences in practice. More specifically, we investigated what works best in different museums in terms of digital technologies and apps. To do this, we evaluated mobile applications, evaluated a set of electronically based visual activities in museums, also known as digital experiences, and interviewed stakeholders in various museum app development programs. The investigation of the specifications of mobile apps developed by museums, archives, and libraries as well as those developed for philatelists and stamp enthusiasts acted as the basis for qualifying the differences in these technologies.

Interviewing Staff in App Development Programs

We interviewed staff at designated museums that the BPMA considers relevant in order to flesh out the details about the development and use of different apps and technology in their respective museums. We identified these staff members with referrals. The first few people and museums were identified in collaboration with Alison Bean, the Web Officer of the BPMA and our group. Table 2 lists museums and staff chosen by the BPMA and our team as valuable to the project. From looking up museums similar to the BPMA online and looking to past IQP papers of this type, we have identified these as important first interviews because they offer insight into the process of app development. All listed here have either experience developing emerging museum technologies or developing apps in the past. Our group needed to know the process other museums take to develop apps so we can follow a similar process with the BPMA. We also asked at the interviews for referrals to other that they know are valuable resources on the subject matter of app development and technology infrastructure.

Museum Name	Person Interviewed

Boston Science Museum	Miriam Ledley (CCP Coordinator)
Grant Museum of Zoology	Jack Ashby (Manager)
London Science Museum	Carin Grix (Senior Licensing Manager); Kayte McSweeney (Audience Advocate and Researcher)
Natural History Museum	Marie Hobson (Learning Evaluator) and Yuki Geali (User Experience Designer)
Smithsonian National Postal Museum	Marshall Emery (Manager, Public Relations & Internet Affairs)
London Film Museum	Julian Wellek (Developer of i-Tour)

Table 2: Currently interviewed stakeholders and their respective museum

These interviews were either in-depth and semi-structured conversations or email correspondence. We took notes during the interviews and only paraphrased responses and ideas in note form. The interview preamble and the primary set of questions asked are in Appendix B: Interview Questions of Stakeholders.

Resources a museum needs to develop an app

We needed to gain an understanding of why museums want to develop apps, and what resources are necessary to create one. Our questions were what makes a museum invest in an app and what should be the focus for a museum when in development. The interview with Carin Grix, the Senior Licensing Manager at the London Science Museum, offered valuable responses to these questions. Information about the feasibilities of new technologies and investments a museum makes when developing an app was extremely helpful.

How to design a prototype

We wanted to learn about the process of prototyping from both a learning standpoint, and a usability standpoint. We interviewed Marie Hobson, the Learning Evaluator and Yuki Geali, the User Experience Designer at the London Natural History Museum to answer our questions about learning in museum exhibits. Speaking with them raised questions of content and usability of digital experiences both in the museum and on mobile devices. We found this information in a conversation with Kayte McSweeny, the Audience Advocate and Researcher, from the London

Science Museum. With years of experience in prototype development, Kayte McSweeny shared knowledge about interacting with audiences when evaluating content. She brought the work done by the WPI group that worked on their E term 2012 project creating an app for teachers to use as a resource in one of their exhibits. She offered insight into what the museum decided to do with the past IQP group's recommendations and how successful the recommendations were. This information also helped with our question of what a museum would value from a project like ours.

How to generate content

One crucial question our group had was how to create content for an app. There is a large amount of information about stamps including history, design, and its make. We wanted to know how to organize this information on a digital experience. To answer this question, we looked to The Smithsonian National Postal Museum in Washington, D.C., and its Arago virtual exhibits. The Smithsonian National Postal Museum is the largest postal museum in the United States, and provides similar content in its exhibits as the BPMA will in their new museum. We were in email correspondence with three members of the Web Team Marshall Emery, Bill Lommel, and Jeffrey Meade who are responsible for Mobile Learning. We asked Mr. Emery questions about how the museum chose to display information about stamps.

Generating content for a mobile experience presented another question for our group. We needed to know how to display content on a mobile device. We got in contact with Julian Wellek, one of the developers for the i-Tour app at the London Film Museum. He offered information about how developers display different types of content on mobile devices. He showed us how i-Tour displays content and the thought process a developer will take when designing an interface around content.

How to evaluate an app

Our group wanted to learn about the development and evaluation process of apps currently in test. We interviewed Miriam Ledley, the CCP coordinator and tester of the ByteLight system at the Boston Science Museum, with full notes in Appendix K: Notes from Interviews with Museum Stakeholders

Miriam Ledley from the Boston Science Museum. We spoke specifically about how she went about evaluating different audiences and what in particular she had to say about the evaluation process.

A primary concern involves how audiences interact with museum objects and digital objects, if one detracts or aids the other. The group asked questions about user response to questions, different levels of audience interpretation, and the overall impact of user-generated content on the museum and its staff with Jack Ashby, the Manager of the Grant Museum of Zoology. He answered questions about the QRator app and audience participation in museums as referenced in the notes in Jack Ashby from the Grant Museum.

We developed evaluation criteria for app evaluation from these interviews and the one with Yuki Geali, the User Experience Designer at the Natural History Museum. We needed these criteria to identify which apps are more successful. Our criteria are similar to those that museums use to evaluate their exhibits as well as those that calculate the QoE of software. The quality of experience (QoE) for software is the evaluation of how well it performs the given function for its users. The difficult aspect of software evaluation, especially mobile applications, is being able to capture as many aspects of the application and the environment that affect a user's experience. Our decision was, as Dey, Fiedler, Hong, Ickin, Janowski, and Wac did in their study, that "measuring QoE for real application users in their real environments is the only chance to bridge the gap between lab studies and real measurements and implementation. To this end, our approach uses mixed methods, incorporating qualitative and quantitative methods" (Dey, 2011). This method is a good approach as the quantitative data will show standardized measurements of success and the qualitative data will explain more clearly a user's experience. We created a list of criteria that quantifies and a list of questions that qualifies each mobile application, as found in the Appendix G: Criteria for App Evaluations for apps and Appendix I: Criteria for Museum Digital Experience Evaluations for museum digital experiences.

Once we had all of the criteria generated and our evaluations, we needed a medium to perform evaluations. Our choice was to use Microsoft Excel to document all of our evaluations. In Appendix H: Sample Evaluation Sheet for App Evaluations, there is a sample Microsoft Excel

sheet that outlines both the qualitative and quantitative aspects of the evaluation. A metric with average scores for each criterion category and average score for all criteria created a final definitive score for the select evaluation. There was also qualitative questions asked in each evaluation to answer what the user was thinking when using the app and clarified any points of discussion.

What must be done with a released app

Our group looked into what steps a museum takes after the release of the app. We wanted to know if there is any continued development or not. To get this answered, we asked questions in the interview with Jack Ashby from the Grant Museum specifically on how sustainable QRator has been now that it is over a year old.

We also wanted to know if there was any interaction between the museum and the development company after release. When speaking with Miriam Ledley from the Boston Science Museum, our group asked questions about her experience with a development company. Another interview that answered this question was with Julian Wellek from the London Film Museum. As a developer himself, he provided answers from a development company side.

The interviews provided much needed qualitative information about museum app development. The information learned in these interviews helped our group to shape a process we can follow when developing our app. It also helped to determine what works and what does not work from a museum staff standpoint. All the information compiled will help make our recommendations to the BPMA much more valuable as they helped establish what a museum would find useful.

Evaluating Mobile Applications

From the interviews and process for app development, our group needed to identify accurately the differences between mobile applications. We used the evaluation criteria we created in Appendix G: Criteria for App Evaluations for apps and Appendix I: Criteria for Museum Digital Experience Evaluations for museum digital experiences to evaluate the apps listed in Table 3: Apps currently evaluated and their respective museum. Advice from Alison Bean, the Web Officer of the BPMA helped our team to create this list. We chose these because

museums in London developed them so we can easily travel to see them in person. While using each, we found ourselves proposing questions about our experience. Some questions we asked ourselves were why the app existed, and what its overall purpose is. The answers to these questions helped us to generate a framework about app use in museums. We focused on which was more successful and why. Specifically, we wanted to know the different ways to do the following: motivate museumgoers, engage museumgoers, make an app usable, and present content on an app. The list we evaluated and the museum that developed and released them are as follows:

Museum Name	App Name
Boston Science Museum	ByteLight
London Science Museum	James May, SCVNGR
National Galleries of Scotland	Art Hunter
Grant Museum of Zoology	QRator
V&A	Audio Tour
Natural History Museum	Vusiem

Table 3: Apps currently evaluated and their respective museum

Different ways to motivate users

Different apps have different ways to motivate an audience to use them. We needed to determine what motivates users to use apps over other forms of technology in museums. The Victoria & Albert Museum (V&A) offered an app that acted as an audio tour that provided some additional information for the medieval section of the V&A. We wanted to know what would motivate a user to download this app rather than use that audio tour guide device already offered. The Science Stories with James May from the London Science Museum used a celebrity to dictate the information in the app. One scans a unique image on display in the museums and creates a 3-D avatar of James May to speak to you and provide more information about the object. Speaking with Carin Grix from the Science Museum also answered if the celebrity appearance made the app more successful in comparison to others at the museum. One can use an app on site in a gallery as well as off site. Apps with off-site use needed a motivating factor to use outside the museum. We evaluated these off-site experiences to determine what motivates

one to use them. QRator, for instance in the Grant Museum of Zoology, offered a website that one access from home. Speaking with Jack Ashby about how successful the website is as well as using the online experience ourselves, we could evaluate if QRator motivated users enough to go to the website.

Different ways to engage users

We wanted to know what the different options are on apps that engage users. Did the option to interact with other users engage one to use it longer was one question we answered with SCVNGR from the London Science Museum. It allows one to check into different locations and perform tasks to collect badges. SCVNGR also allowed one to create a task or journey to complete and share with friends. We wanted to know if a collection of badges and sharing with friends engaged people even if it offered less content than other apps. With our evaluations and own use of the app we found answers.

Similar to SCVNGR, Art Hunter, developed for the National Galleries of Scotland, offered an experience where one collects items. Art Hunter allows a user to collect different artwork he finds in the gallery of the museums. The more artwork one has, the greater number of trophies he earns on the app. We wanted to know if this act of collecting and earning a "prize" engages users enough to use the app more than once. We looked to our evaluation of the app and our own experience with it to determine if this did engage users.

What makes an app usable

While looking at all the different apps, our group thought some to be easier to use. Our evaluations of the different apps also showed the differences in usability between them. We wanted to know what about an app made it usable. To do this, we looked at an app that was very easy to use. ByteLight, of the Boston Science Museum, had an intuitive interface that took no instruction to know how to use. The technology involves lighting installed in the ceiling and an iPad or other mobile device with a front facing camera. To use it, one simply walks around the museum exhibit. As one moves around, the content on the display changed. We discussed among our group and with Miriam Ledley why ByteLight was easy to use. We also spoke with Yuki Geali about the subject of usability, as she was the User Experience Designer at the Natural History Museum and could answer our questions about app usability.

Different types of content

The content in apps is as different as the apps themselves. We wanted to know what the different types of content in museum apps are. To answer this question, we looked at the differences between QRator from the Grant Museum of Zoology and Vusiem of the Natural History Museum.

QRator allows visitors of the museum to type their thoughts about an exhibit and present them as part of the display ("What is QRator?", 2013). QRator proposes questions to museumgoers and displays user responses to other visitors. In this way, all content on the app is user generated. We spoke with Jack Ashby and looked at our evaluation of content to answer our question about how this type of content either improved or weakened the museum experience.

Vusiem is the opposite of QRator in terms of content, as none of its content is user generated. The application contained much information already presented in the Natural History Museums collections and exhibits. The app also provided maps of the museums for museumgoers to navigate around when at the museum. Our interest in this app specifically was because of the content it offered. The questions we wanted answered were what content the app added to the exhibit spaces, if any, and what would entice one to use it in the museum.

Evaluating Digital Experiences in Museums

To gain a wide perspective on the possibilities of digital technologies museums may pursue instead of apps, we evaluated digital experiences in museums as well. We modified the evaluation metrics from the app evaluations for the museum digital experiences as many of the criteria to evaluate were similar. The qualitative information from these evaluations also helped to identify what makes a digital experience one that people learn from and actually remember. With this knowledge, we were able to replicate a similar experience on a mobile platform that is just as valuable as an in-museum digital experience. To do this, we needed to ask questions about what made a digital experience successful. Just like the app evaluations, we wanted to know the different ways to do the following: motivate museumgoers, engage museumgoers, make an app usable, and present content in a digital museum experience.

With these criteria and questions, our group evaluated many different digital experiences in museums. We visited the museums in Table 4 and simply found these digital experiences as

average museumgoers. The list of digital experiences evaluated and the museum that housed them are as follows:

Museum Name	App Name
Natural History Museum	NaturePlus, Mosquito Activity, Comments Board, Survivor, Treasures
V&A	Computer Archive, Exhibit Kiosk
London Science Museum	Web Lab Percussion, Web Lab Networking, 3D Printing, Ouch, Carbon, Who Am I
Museum of London	Games Station, Touch Screen, NFC

Table 4: Currently evaluated digital experiences at museums and their respective museum

How museum digital experiences motivate users

How museum exhibits motivate museumgoers to use the different stations is different from how museum apps motivate users. We wanted to know the different ways museum digital experiences specifically were able to motivate museumgoers to use them. To answer these questions, we evaluated why we approached some stations and not others.

One of the largest digital experiences we saw in the London Science Museum was the centerpiece to the London Science Museum's carbon cycle exhibit. This type of digital experience not only interacted with a user, but also with the exhibit environment. We wanted to know if a large digital experience motivated museumgoers to use it over other stations. Our evaluations of the exhibit and our own experience with this station answered the questions. Another large digital experience was the centerpiece of the "Who Am I?" exhibit in the London Science Museum. When completed with the experience, the interface creates one's user profile. The giant wall in the back of the exhibit stores and displays every user profile generated at this table for everyone to see. We found out if this large digital experience motivated people to use it from our evaluations and observing museumgoers who approached the station.

The Science Museum had an abundance of benches scattered in almost every exhibit. These benches were not only a good place to sit down, but also had touch screens available for

use that still offered museum content to museumgoers. Our group wanted to know what would motivate someone to use these stations instead of others in the exhibit through evaluation. One of our evaluations of this type of station was about a small 3D printer set up near one of the benches that asked questions about one's knowledge of 3D printing.

How museum digital experiences engage users

When there are many stations to interact with in a museum exhibit, there are different ways to engage users. We wanted to know what the different ways museum digital experiences engage museumgoers are. To do so, we evaluated a few types of engaging experiences we saw most often including the collection of things, games, and following a narrative.

To evaluate how collecting things with a digital experience, we looked at NaturePlus in the Natural History Museum and the Web Lab exhibit in the London Science Museum. NaturePlus is the combination of touch screen kiosks and a swipe card one carries around the museum. One was able to select an object on the touch screen, scan the swipe card, and add that object to his "collection" and learn more about online later. In addition, in the Web Lab, one would receive a card at the entrance of the exhibit space that one would hold onto and "collect" different things around the space. One station in the exhibit was a Percussion station where one could make a song and store it on their card. Our group wanted to find out what about this experience do people actually like and use, and how does the idea of "collecting" objects around the museum engage different audiences.

For games in digital museum experiences, we evaluated many stations in several museums. We wanted to know if a game experience actually aids in the learning of the exhibit, or if it merely is something one would play for fun. In addition, our team wondered how the content of a game translates to a take away for the museumgoer. Survivor, a three-person game in the Natural History Museum's temporary exhibit space, taught survival strategies and how species evolve and learn to survive by pitting your species with certain characteristics against other species in a world plagued by natural disasters and a changing climate. The concept of a quick strategy game that pitted multiple players against each other interested us greatly. In the London Science Museum, a new game experience just rolled out in the pain exhibit. The game, called Ouch, is a touch-screen game that challenges players to ease the pain receptors in the brain. Another game station in The Museum of London in its medieval section offers an

experience that tries to explore how one would use the artifacts in the exhibit in daily life. The games on this station, catered for a younger audience, proposed questions about how a museum can engage younger audiences.

We found a narrative style of engagement, or one where the experience followed a storyline, on a few digital museum experiences and we wanted to find out how much more successful engagement of this type was over others. We did this by evaluating two stations with a narrative. One in the Natural History Museum was a multiuser touch screen where one had to stop the spread of Malaria by capturing Mosquitos, extracting DNA, and synthesizing the gene sequence. The second narrative style station evaluated offered a quiz experience that if one scored high enough, he becomes an apprentice in gun making or watchmaking. The narrative greatly tied the objects in the exhibit to a real life experience.

What makes a museum digital experience usable

While using the different digital experiences, our group found some to be easier to use. We wanted to know what the differences between these digital experiences that made them easy or difficult to use. Differently from apps, digital experiences offered many different ways to navigate through content. We evaluated these types of usability to understand what an app cannot do for usability. One such way is with a keyboard. The Victoria & Albert museum's computer archive of objects that offered a database of artifacts and objects from around the museum used a physical keyboard on a desk to navigate. The Natural History Museum's comments board station, however, used a touch screen keyboard. From the evaluation of these experiences, our group identified their differences in usability.

In games digital experiences, we wanted to know how game controls affected usability of the digital experience. The Natural History Museum's Survivor game for example had very different controls than other digital experiences. The controls of the game were a touch screen pad on the left hand and an invisible joystick for the right hand. The invisible joystick was actually a camera that followed one's hand movements and would direct the player toward the direction one's hand moved.

Another different form of usability for digital experiences is the use of near frequency communication (NFC). The Museum of London installed this technology on some of the

displays there. If one has an NFC enabled phone, he can simply tap the display and have new information pop up on the phone. When a phone connects with the display, a browser window opens up directing the user to a website that has detailed information and photos related to the object on display. The information there is more in depth than what is on the object's label. One question our team proposed is, if this type of usability means an app is not necessary to display content.

Content for museum digital experiences

Content on display in digital museum experiences varies from station to station, and our group wanted to learn about the different types of content available. With knowledge of what a museum digital experience already offers, we can better determine the content to put on an app.

This digital archive in the V&A offered a museumgoer a database of artifacts and objects from around the museum that one could search through to find out more about them. Our team focused on what content we could find when one searches an object and the layout of content. The display is small, but the number of objects it has access to is vast, so we wondered how it portrays a large collection with limited space. Another digital experience in the V&A was a small kiosk located in the middle of the exhibit space. The information on the display here was about the objects in the exhibit and had a quiz to test one's knowledge of these objects. The question here we wanted answered was if one actually reads the content. To determine the answers about content, we used our evaluations of the digital experiences to see if the content aided the exhibit at all.

In the Natural History Museum's Treasures exhibition, digital touch-screen labels display varied content for each object. A user can scroll through the content at will and can scan a QR code to receive duplicate content on their mobile device. We were interested in how a digital label's content affects the user interaction with the object, as compared to a static display.

Together with the interviews about museum app development, app evaluations, and evaluations of digital experiences, we were able to see what worked well on a number of categories. We wanted to see if an app experience or an in-exhibit experience better-facilitated motivation, engagement, usability, and content distribution. We used this information to base the

next aspects of our project in a better context. We created recommendations of what to avoid when developing apps and digital technologies from this context. With the information learned here, our group made a strong recommendation to the BPMA for the creation of their stamp collector's app.

Objective 2: Determine the Interests and Needs of Key BPMA Audiences

We assessed the needs and wants of targeted BPMA audiences of a digital stamp-collecting app before the development of a prototype. This assessment included how comfortable the audiences are with digital technology, what would motivate them to use such an app, what content they would be interested in, and how receptive they will be to the virtual display of the stamp collection. An ongoing aim of the BPMA is to offer access to their stamp collection to a wide range of audiences. The BPMA intends to cater to the needs of several target audiences to ensure the success of the New Center. These audiences are:

- Family groups with children aged 3-16 years
- Independent adults without specialist knowledge in postal heritage
- Primary school groups seeking support teaching History, English, Art and Design, and Information and Communications Technology (ICT)
- Adults in London-based social clubs and societies with a strong interest in informal learning - e.g. local history groups, drawing and art classes, the Women's Institute (WI), the University of the Third Age (U3A)
- Adult hobbyists and researchers with special interest in philately, postal heritage, and/or family history

The BPMA has conducted marketing research into the attitudes and behaviors of the many different audiences of the museum, and provided the results of this research for our review. In an effort to gain a better understanding of the expected visitors to the BPMA's New Centre, we analyzed the research by reading through each document several times and collecting information relevant to these audiences and their interests. We did this before conducting any additional interviews or surveys. Using this market research and museum evaluations, we concluded that the app would not cater for all of these target audiences so we identified a specific target audience for the app. The reports referenced were "Heritage Lottery Fund (HLF) Activity

Plan", "BPMA Online Audiences Survey", "Quantitative Attraction Evaluation Presentation of Results", "British Postal Museum and Mail Rail Visitor Estimation Research", "Branding and Naming: Feedback from Potential Visitors", "A New Visitor Attraction on the History of the Postal Service: Audience Development Research", and "BPMA Omnibus Scoping".

The "HLF Activity Plan", written by BPMA Access and Learning Manager Andy Richmond in February 2013, provided the results and summaries of focus groups, interviews, questionnaires, and online surveys conducted by the BPMA in 2011 and 2012 to evaluate the needs and wants of current and potential audiences. Alison Bean's "BPMA Online Audiences Survey" of 2011 summarized the results survey posted on some of the social media pages of the BPMA to collect data regarding the online audiences and their use of social media sites and the BPMA website. The survey was 90 questions long and taken by 70 people, although only 57 completed it. The marketing company Touchstone Partners Limited presented the "Quantitative Attraction Evaluation Presentation of Results to the BPMA" in September 2012. This report defined target audiences of the museum, and determined how the inclusion of different exhibits such as the "Mail Rail" exhibit would affect the interest of different audiences in visiting the New Centre. Additionally, Touchstone developed the report "British Postal Museum and Mail Rail Visitor Estimation Research" which provided information regarding what the museum's various target audiences, specifically families and adults over the age of 55, want in a museum as well as what they do not want. The company Creative Research developed two reports for the BPMA: "Branding and Naming: Feedback from Potential Visitors" and "A New Visitor Attraction on the History of the Postal Service: Audience Development Research". "Branding and Naming: Feedback from Potential Visitors" identified the core target audience for the new museum as families with children, and surveyed this specific audience as well as teachers to determine what they would be interested in seeing in the new museum. "A New Visitor Attraction on the History of the Postal Service: Audience Development Research" featured data from focus groups of key audiences, and provided specific quotes regarding their hopes, concerns, and expectations for the new museum, as well as ways that exhibits such as the stamp collection could be made more appealing to these audiences. Finally, the "BPMA Omnibus Scoping" created by Touchstone analyzed the general population around the museum to determine what their museum interests are.

After using the extensive marketing data from the BPMA to determine the target audience to focus on for the project, we conducted our own investigation to supplement the research findings. This investigation focused more on the receptiveness of the expected museumgoers to an app of this type and on the content that should be included to satisfy the target audience. Appendix C: Initial Survey Questions and Topics contains an initial set of questions aimed at addressing the audience's level of comfort with mobile devices, their involvement with the BPMA, and their thoughts on the creation of the app including any content of interest. In collaboration with staff members of the BPMA, we edited and developed this initial set of questions and topics in more detail to obtain the information necessary for the needs assessment and to build upon previous research. In focus groups and interviews, we used this survey as set of base questions to ask all participants to compare all results, in addition to the specific questions related to the purpose of the focus group or interview.

Currently the BPMA has a blog, as well as Flickr, Facebook, Pinterest, and Twitter accounts. We distributed a link for the final survey to these social media accounts. Using Google Form, we created the survey so the responses would automatically update in our Google Drive, and focused on getting a better understanding of who is currently accessing BPMA information. Another result of the survey was to find out what BPMA audience attitudes are towards a stamp app. We ran a pilot test by emailing the survey link to the student team to complete before posting the survey on the social media websites. This test identified any problems with the link and survey in general so we could make the necessary corrections. We collected data from these surveys in a Google Spreadsheet, grouping similar answers with key phrases together for the open response questions, so that the information was in one location. The social media survey ran for one week before we collected the data, but will continue to run so the BPMA staff can view incoming results for however long they consider necessary. In addition to social media, we further developed the survey in collaboration with BPMA staff having stamp collectors' and philatelists' interests in mind, which the BPMA can include in their Newsletter to distribute in May/June. Instructions will be included stating that the survey can be mailed in to BPMA headquarters. A written version of the survey will also be included in the London Stampex

welcome pack in September 2013. Participants can give this survey to BPMA staff present at Stampex or mail it to the BPMA headquarters.

We attended the BPMA event "Pillar Box Perfection: Open Day at the Museum Store" on April 6, 2013. At this event, the team set up a table in the Museum Store that was central to the exhibit, with surveys and printed photographs of the Tyrian Plum Stamp, Machin Stamp, King George V Seahorses Stamp, and a photo of Freddy Mercury's stamp collection. The purpose of the survey was to determine the content that attendees of museum events would want included in an app, as well as what they may not want included. When visitors approached the table, we asked them to fill out the survey containing the questions from Appendix D: App Content Survey and facilitated a discussion with several participants regarding their interests in the stamp photographs we brought to the event. We compiled this data in a Microsoft Excel spreadsheet with the social media surveys, grouping similar answers with key phrases together for the open response questions. After visitors had filled out the survey, two of the team members asked the participants general discussion questions regarding their interests in the stamp photographs, while one team member took notes on their responses and behavior. Based on previous research experiences by BPMA staff members, we adjusted the manner in which we collected data. By determining the target audience as well as their level of interest in a stamp app and input on the content, we could move forward with our project and formed ideas as to what should be included in the app.

To further reach out to philatelists and stamp collectors, our sponsor Martin Devereux put us in contact with philatelist Richard West who frequently visits the BPMA. The purpose of the interview with Mr. West was to discuss the motivations behind and interests in stamp collecting, and his experience with digital technology. Additionally, we wanted to know how stamp collectors use the resources currently provided by the BPMA, such as the online catalogue, and what else may be useful for them. This interview was a general discussion with questions based on, but not limited to, those found in Appendix E: Interview with Philatelists. Two group members asked the questions while one wrote down the answers to the questions and other general notes on the direction of the conversation. This interview gave insight into any interests stamp collectors would have in the stamp collection app.

Objective 3: Clarify BPMA Goals and Identify Design Criteria and Content

Throughout our investigation of audiences and best practices, we have continuously reported our progress to our sponsors. We held weekly meetings with key staff members of the BPMA in order to clarify their goals and eventually identify design criteria for the app.

Topics that we discussed during our meetings include:

- Information that the BPMA has gathered on their audiences
- Details of the artifacts included in the archive's collection
- Structure of the exhibit space in the upcoming museum
- Organizing museum visits and interviews with important members of other museums
- Defining important evaluation criteria
- Identifying possible interviews with relevant audience members

We combined the information that we gathered in our evaluation of best practices and our consultations with our sponsors in order to establish our approach for developing the app prototype. When developing the app, our first step was to identify its content. We defined the content of the app by a combination of suggestions from the BPMA staff and by the results from the data collected from our research. The BPMA is interested in developing the following possible content ideas:

- Intelligent Stamps: allows users to scan stamps with their phones in order to acquire additional information on the stamps. This software uses image recognition and augmented reality technologies.
    - Using the app would allow users to scan their own collections to display related or additional content from the BPMA's collections.
    - Visitors could use this to scan stamps on display to access in depth information and other material such as videos.
- Create Your Own Stamp: This would give visitors the opportunity to create their own stamp using the Smilers system or by taking photos in the exhibition.

- Great Britain Stamps - issue by issue: digitally display material related to every stamp issued in the UK.
- The R M Phillips Collection: display this award-winning collection of stamps. It provides important background for understanding postage stamps and philatelic research.
- Additional Resources: provide a philatelic glossary, advice for taking care of stamps, and general information about viewing the collections at the Royal mail Archive
- Retail: include access to the BPMA's online shop and offer products for sale.
- What's On: listing of BPMA events and exhibitions, with information on current and upcoming philatelic events.
- Connecting: allow easy sign-up to BPMA's e-newsletter and social media streams.
- Social Media Integration: include access to social media. (Bean, 2013)

In addition to the suggestions above, we brainstormed our own ideas for the app content founded on the research of our chosen audience.

Objective 4: Design and Evaluate the App

With all the compiled information from the target audience, the BPMA's goals, and our evaluations, we worked on developing prototype of the app. Our team created a prototype by using Power Point. The research from Objective 1 and the conclusions from Objective 3 defined the overall concept of the mock-ups. Specifically, we used the evaluation graphs included in Appendix N: Sample Graphical Models for Evaluations. These graphs include our overall scores for mobile apps and exhibits that we evaluated for Objective 1. Moreover, the templates have graphs showing the demographics for those apps and their scores for each evaluation category. When our group created the prototype, the target audience was another influencing factor. This referred to the data gathered in the interviews and surveys from Objective 2. We developed the prototype to the extent that we determined previously in the brief of Objective 3.

We considered the Power Point presentation as an initial prototype of the app, which we used as a tool to evaluate appeal among audience members. Our team decided to evaluate this prototype by using a focus group. The focus group was comprised of individuals that belong to different sets of the audience spectrum. During the focus groups, each one of us had a specific

role. We assigned a note taker, an observer, and a facilitator. The note taker was responsible for recording relevant data from the responses of the participants. The observer took notes on the behavior of the participants and served as a facilitator when necessary. The task of the facilitator was to read the preamble and to ask the questions in Appendix F: Evaluation of Prototype. Moreover, this person was in charge of guiding the discussion along a predetermined subject area. The focus groups specifically focused on gathering participants' opinions on the prototype.

Using the feedback from the data recorded during the focus groups, we made changes to our prototype in order to appeal better to the audiences. This concludes one full cycle of evaluation. If the BPMA decides to continue developing this app, we recommend that they repeat this cycle multiple times to achieve the best result. The BPMA should thoroughly evaluate the prototype for the iteration of this process.

Objective 5: Future Recommendations

Our final objective is to provide recommendations for the continued development of the mobile app. If the BPMA decides to create a mobile app, it should consider and further develop the following list of topics:

- Financial analysis of costs and risks for app development
- Develop technologies used in app.
- Investigate how to implement adequate usability
- Maintainability
- Marketing
- Evaluation of the app after implementation

In addition to the previous topics, our recommendations include our findings in three key areas:

- User needs, attitudes, and behaviors
- Benchmarks
- Content

We have a set of deliverables that formed part of our recommendations. We provided the prototype that we developed throughout this project so that the BPMA has the option to continue

with its development. We gave the BPMA a complete evaluation of all the apps and interactive exhibits that we investigated in Objective 1. We attached the evaluations in Appendix O: Sample Graphical Models for Recommendations. The graphs in this evaluation depict an overall score, an analysis of the demographics, and the scores in each evaluation category.

Findings

In the following section are the details of the analyses of our first four objectives, separated into four different categories of app development: necessary resources to develop an app, content and design, evaluation, and considerations after release. These analyses include discussions of interviews with museum staff and stakeholders, surveys and interviews with target audiences, and detailed evaluations of technology in museums. We discussed the results for the final objective, future recommendations for the BPMA, in the next section titled Recommendations.

Museum and App Evaluations

From visiting other museums, we found how they develop and use various types of technology. As observers and museumgoers ourselves, we wanted to use the different technologies and learn how they affected our experience in the museum. With our evaluation criteria from Appendix I: Criteria for Museum Digital Experience Evaluations, we evaluated each digital museum experience from various museums around London and stored the evaluation on excel sheets like the one in Appendix J. After completing all the evaluations, we compiled all the data on an excel sheet like the one in Appendix O. The final evaluation of the digital museum experiences shows a few findings about what makes a successful digital museum experience, from**Error! Reference source not found.** Appendix Q.

From our evaluation, we found there was a large number of touch screen kiosks in the museums. These are mainly for a museumgoer to play a game, or take a short quiz about the content in the exhibit. Although each kiosk had different content to display, their premises were all the same. One who used these kiosks learned only a small piece of information from the exhibit. Each catered a short narrative or small piece of information to present to the museumgoers. One would simply walk up, play the game, and walk away. This shows a stark contrast to our evaluations of apps. Apps offered large amounts of information both in and out of the museum because the content is expandable. Most apps only offer a small amount of initial information, like a title to different sections, but once clicked, the sections open up to reveal more content. In this way, an app better suits the presentation of large amount of information, like the BPMA stamp collection.

From both evaluations of museum technologies and apps, we found there to be similarities between them. Since both experiences are digital, their interfaces often only differed because of the size of display. Larger displays offered more to look at than smaller displays simply because there is more room to do so. The most successful interfaces however were often the most intuitive. An uncluttered, non-intrusive, and more automatic interface delivers content to users much more easily. Interfaces that were difficult to navigate in our evaluations however, often did not present all their available content to users because one could not navigate to it. An app's usability then correlates to how much information one receives. High usability or easy to use navigation presents content clearly. In this manner, apps with low scores in navigation often became obstacles in the museum galleries. When using an app in the museum, one should not feel disconnected from the objects and information on display. This can happen from both poor usability and content that does not add to the museum space. If an app had duplicate content as what is in the exhibit, the app often became frivolous and no one would wanted to use it.

We also conducted interviews at museums with several museum staff that have developed apps in the past. From these interviews, we compiled the several experiences with museum staff and their process for app development. We found that all processes for app development follow the same generic outline. This outline, as presented in the flowchart in Appendix P: Flowchart for App Development, starts with a museum making considerations about the required resources for development, then move to design and evaluation of a prototype with a defined audience and content, and finally to the release of an app with constant upkeep after release. We followed this process in our project with our prototype app for the BPMA's stamp collection.

Necessary Considerations to Develop an App

Developing an app requires a lot of time and money. Carin Grix, the Senior Licensing Manager from the London Science Museum, explained that on average the price range to develop an app ranges from £30,000 to £70,000. In addition, there are varying costs to maintain the app. App development poses a greater risk for the BPMA than for larger museums with more funding since it is a relatively small museum and an investment of this magnitude could demand more resources than available. The 1 to 2 year development period consists of the conception of

the idea for the app, all the way through developing and testing, and finally to the app's release. As the new museum will open in 2016, considerations for the app should start now.

The museum must look at its core values and see if an app ties to the greater context of the wants and needs of that particular museum. The gallery space in the new center in 2016 will consist of different time period zones with many interactive stations. Understanding the social mechanics of this space will be crucial to ensure an app will not detract from the gallery experience. For example, one station in the new museum will be a costume dress up area for children. A child should not have to put down a mobile device or give it away just to use the station. Understanding the role of an app in the gallery will help to determine how the app aids the space rather than distract from it.

For the BPMA, their on-site and off-site audiences vary greatly and considerations of which experience they wish to focus on will change the development of the app. For instance, the off-site audience, mainly hobbyists and those connecting to the BPMA online often have specific items they wish to search and look up information about. The on-site audience, museumgoers, in contrasts consists mainly of families and younger individuals who do not have a particular interest in mind. Targeting one audience or the other will benefit the app to fulfill the needs of the BPMA audiences. Based on the average overall score for on-site apps and apps that are both on-site and off-site from Appendix R: App Evaluation Final Charts, we found that on-site apps are generally more successful than off-site apps. The average for apps used in museums was 3.38 and only 2.96 for apps used outside the museum. The difference between these two types of apps is the level of interaction and relevance to the exhibit space. An off-site app scores lower for these categories, showing that the experience offered is not as rich as an on-site app that interacts with objects and the exhibit space.

App Content and Design

To ensure the success of the BPMA's New Centre, a primary goal is to cater to the needs of several target audiences. These audiences include family groups, independent adults, school groups, adults in London social clubs, and philatelists. Before development of an app, the developers must envision a defined audience and create content that will appeal to this audience, according to Kayte McSweeney of the London Science museum. We chose to focus on general museumgoers at the New Centre, as we believe these visitors to be the ones most likely to use

the mobile application. This audience includes families with children, students, and independent adults. We assessed the wants and needs of these targeted audiences, also considering the interests of philatelists, to determine the possible interest in a virtual display of the BPMA's stamp collection before the creation of a prototype.

Current and Expected BPMA Audiences

In order to gain a better understanding of the audiences, we reviewed previous market research, interviewed a philatelist, conducted surveys and discussions at the event "Pillar Box Perfection: Open Day at the Museum Store", and posted the same survey on social media platforms through the BPMA. The current audience of the BPMA consists mainly of people over the age of 55, most of whom are hobbyists interested in postal history, philately, and family history (Richmond, 2013). Of those that participated in the surveys we distributed online via social media and onsite at the BPMA event, 52% were over the age of 55. The raw data from the surveys is in Appendix T: Data from Audience Surveys. Additionally, 45% of the over 55 group were stamp collectors. There was also a correlation between the age groups that had a mobile device and those that collected stamps, in that as the age of the participants increased the likelihood of their being a stamp collector increased but the likelihood of their owning a mobile device decreased (Figure 5). In fact, while almost 29% of those surveyed did not own a mobile device, 67% of those were over the age of 55 and 43% were stamp collectors. However, from the participants that did own mobile devices, 19% had an eBook, 30% a tablet, and 51% a smartphone.

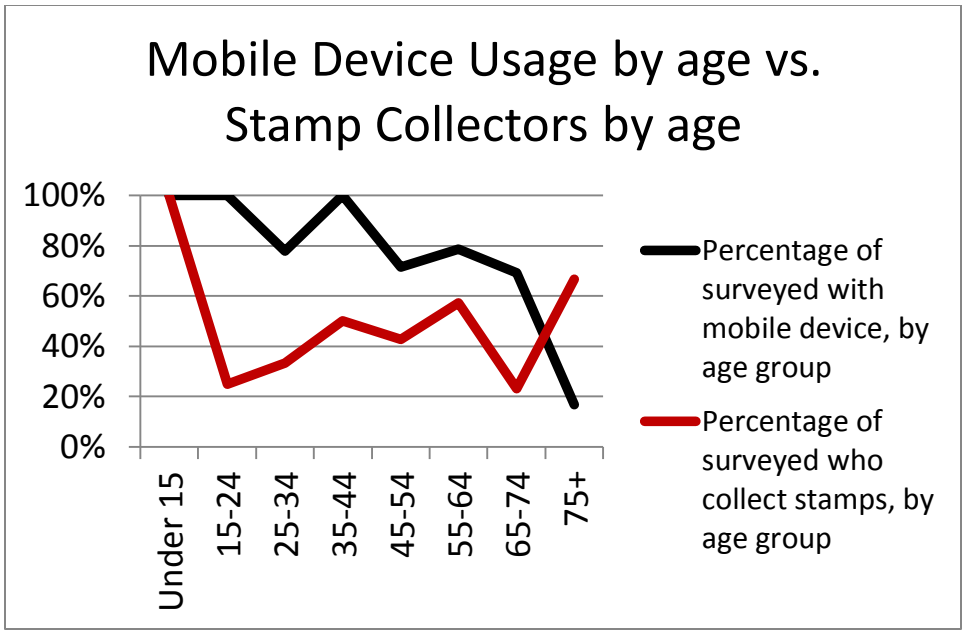

Figure 5: Mobile Device Usage and Stamp Collectors

At present, the only opportunities for visitors to view the collections of the BPMA are by visiting the Royal Mail Archive, Museum Store, and Museum of the Post Office in the Community, or by attending BPMA events. According to the market research, in 2012 there were 1,262 visitors to the Museum Store, 2,871 to the archive, and 174,531 to other BPMA exhibitions and displays. Of these visitors, 59% of the archive visitors were over 55 years old, and 65% of those involved in events were over 55 years old. The primary motivations of these audiences for using the BPMA, specifically the archive, centralized around specific hobbies or interests: postal history (33%), philately (26%), and family history (19%) (Richmond, 2013).

The BPMA has a rather extensive and diverse online audience. In 2012, there were 195,421 visitors to the website, 223,508 blog views, 3,160 followers on Twitter, and 1,482 fans on Facebook. A majority of these online audiences (92%) were over the age of 25, with a fairly even split across those age brackets (Bean, 2011). Of the respondents, 80% have visited the Archive, 40% the Museum Store, and 20% have attended an event or exhibition. Many of these audiences were interested in history, transport, art and design, and science and technology, indicating that some had very specific interests. Additionally, 44% were members of special interest societies. 83% visited the BPMA website and the Collections & Catalogue, Exhibitions

& Events, Social Media, and History pages were rated the most liked or most useful. Of those surveyed, 53% visited the website while pursuing an interest or hobby, signifying that many of these participants were philatelists and stamp collectors. However, only 39% had used the online catalogue, and some wanted things added, while others simply disliked certain features of the Catalogue. If the app is an on-site mobile application that will not be available to many of these audiences, one option to appeal to online audiences may be making the requested changes to the catalogue.

Stamp collectors have very diverse interests and motivations, and it would be very difficult to create an app that would appeal to all philatelists. To comprehend the specific interests of philatelists, a primary current audience of the BPMA, we interviewed philatelist Mr. Richard West, (notes found in Appendix L: Notes from the Interview with Philatelist Richard West). From this interview, we attained additional insight into philatelists' motivation, interests in stamps, and use of technology. It is nearly impossible to place all stamp collectors in the same category as all have very different interests. For example, while Mr. West was particularly interested in the design and printing of stamps, other collectors may be interested instead in artwork issues, specific subjects or themes, the history of the postal service, printing techniques, and the progression of development from the idea to the final stamp. Stamp collectors also have various motivations behind collecting, and the motivations are diverse. Some people have that "spark" to collect, whereas others do not. While many collectors may want to use the app, enthusiasts will still want to visit the archive and examine the stamps in person. For philatelists, the best purpose of the app would be viewing the stamp in high resolution and in making others aware of what the museum has to offer, since not many know of the museum's online catalogue (Bean, 2011). Because of this, stamp collectors were not the primary audience of the app, but we still considered their interests when developing content.

Families with younger children and older non-specialist independent adults were determined to be the audiences most interested in the New Centre (Richmond, 2013). With the creation of the new museum, it will be possible to reach out to children in informal family settings as well as formal school learning environments, and generally, both groups look for a fun, educational, and sensory experience. In 2012, around 20% of the visitors to BPMA events

were under the age of 16, most of who participated in the museum's family days. Additional research from the marketing company Creative Research supports that data, that families want a fun, engaging experience. The "Stamps in Schools" program is also very popular among teachers and students alike. This program introduces students to the history of stamps, and may form the idea of starting their own stamp collection. One teacher mentioned, "In a technological world the children thought stamps had no relevance but this has changed. One of them said, 'I thought stamps are boring but they're really cool'". Another said, "The children were enthusiastic and have been talking with their families at home about stamps," (Richmond, 2013). By presenting stamps in an engaging way that related to their curriculum, the BPMA has interested various participants in this program, both teachers and students, in stamps and stamp collecting. While the final primary audience of independent adults seems very different from families and students, their motivations in a museum are similar according to the Creative Research marketing research. As mentioned, families want a fun, engaging experience, and independent adults are interested in a similar experience that is participatory and interactive while including a fair amount of reading material. By creating an engaging and interactive app with several options available for content and a variety of ways presenting ideas, we can appeal to the target audiences of the museum.

Content & Features

To determine the content and features that should be included in the mobile application, we reviewed the market research as well as the survey results and focus group discussion found in Appendix T: Data from Audience Surveys and Appendix M: Notes from Focus Group on Content & Features respectively. From the audiences surveyed, a majority of stamp collectors and non-collectors alike were most interested in the history and design of stamps for content. History ranked first in both groups, with 93% of stamp collectors and 74% of non-collectors interested, seen in Figure 6. Participants of the focus group specified that they would be interested in both the history of the stamp as well as the context of the stamps in history more than the design. Once the historical context is included, the stamps can become more relatable to visitors other than collectors. Archives are about stories, and by making those stories available to the public, the archive will become more accessible (Appendix K: Notes from Interviews with Museum Stakeholders: Geoff Browell). Similarly, although it was not an included option in the

survey, the focus group was interested in trivia or "fun facts" about the stamps. They referred to this as the "pull" or "wow factor" that would draw audiences to use the app. By explaining how this everyday object is special or interesting, audiences will be curious and want to know more information. Families and children especially would be interested, and they believed these fun facts would keep kids involved in using the app. While the non-collectors of the focus group were not interested in design, 67% of stamp collectors and 68% of non-collectors from the survey were interested. Being able to highlight items and fine detail of the stamps in high resolution on the screen that are not possible with the current BPMA services was very appealing to some audiences. From the Creative Research marketing report, one respondent said that "I think the design of stamps, the changes, is fascinating and you could get lost in that for quite a long while." The survey results also indicated that while 30% of stamp collectors were interested in printing history and 22% in graphic design, less than 20% of non-collectors were interested in each of those categories. This information gathered on the content is not limited to app use only; the BPMA can use it to further develop the website or in other projects to display their stamp collection.

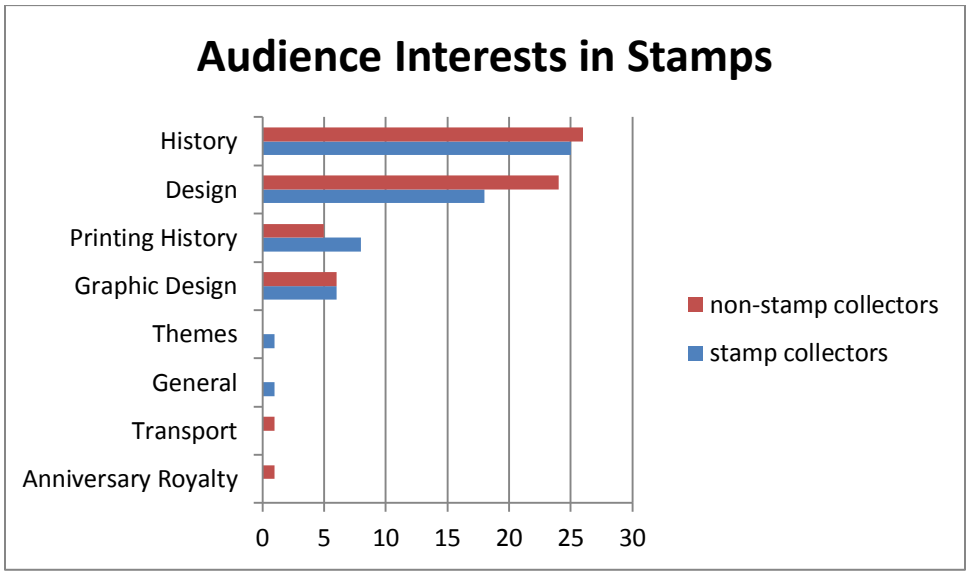

Figure 6: Audience Interests in Stamps

In the surveys distributed and the focus groups conducted, questions were included regarding the features that may be included in the app. We slightly altered the options in this

category after the BPMA event, so there were a few more choices available to the online audiences than to the onsite audiences. These options were: some content was free, quizzes, game, and share information with others. Both online and onsite audiences still were most interested in the app if it was entirely free and included artwork. The online audiences were more inclined to virtually collecting stamps, 23% more than onsite audiences were, and having general information about the museum, 26% more than onsite audiences were (Figure 7). The participants in the focus group were also interested in the idea of virtually collecting stamps; the level of interactivity would make visitors more involved in the subject and exhibit. Stamps are collectible by nature, and the action of collecting stamps through the exhibit would especially appeal to children. With a sign in account and their own collection, users can continue to enjoy what the museum has to offer long after they have left, especially if the technology allows users to take pictures of other stamps outside of the museum and connect those to the BPMA catalogue. The creation of an account would also give the opportunity for users to visit the catalogue on a desktop to view their collected stamps and save any additional research they may conduct. Another difference between online and onsite audiences was that about 22% of the visitors surveyed at the Museum Store said that they would not be interested in downloading the app at all, which was the third highest result for onsite audiences, but only 6% of online participants said they would not download it. This indicates that audiences can access the app in not only the exhibit space, but also offsite at locations around the world. For the additional options added after the event for the online audiences, there was not much of an interest in the inclusion of games or quizzes, but the 45% of participants were willing to download the app even if only some of the content was free.

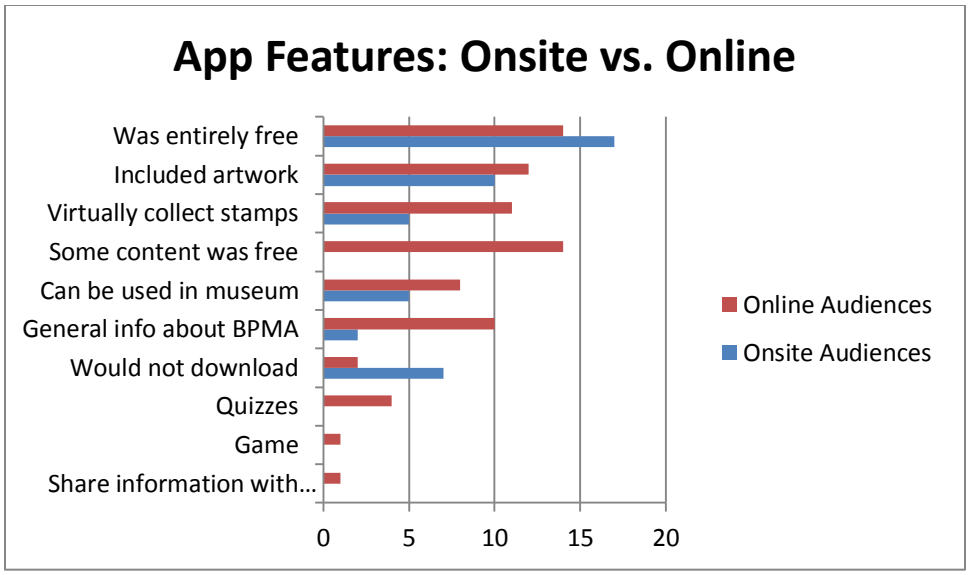

Figure 7: App Features – Onsite vs. Online

Considerations after Release

Many mobile apps become obsolete in a short time frame. The BPMA should consider that most apps have a lifespan of one or two years. The ability to update the app will directly determine the length of its lifecycle. For instance, the app needs to be flexible enough, so that the BPMA has the option to add new stamps continuously and change or remove any content necessary after development. Not only does the app require up to date content, but it must also keep up with software updates specific to the device to remain usable.

Recommendations

Using our findings, we made recommendations based on our previously defined categories that constitute a successful app: motivation, engagement, content, and usability. We advise that the BPMA develop an app using these criteria as guidelines.

Description and Features of our Prototype App

To provide an on-site experience for museumgoers that included content about the history and design of stamps, our group developed a stamp collection app prototype. The idea of the app is to wander around the museum collecting various stamps on the walls learning about both the stamps and the act if collecting. When one enters the museum, museum staff offers him information about the app and he can download it to his own mobile device. Once downloaded, one will create an account with a username and password to login. Within the app, one can browse the various stamps in the collection by time zones similar to the ones in the museum exhibits. The only content available at first is basic information including the date issued and name of each stamp, as well as one "Did you know?" fun fact that makes that stamp unique. All other content about the stamps remains locked. One can unlock content by finding pictures of stamps around the museum and take pictures of them. The app will be able to identify these stamps with image recognition software. This app then adds this stamp to one's own virtual collection. Once one stamp from a given zone has its picture taken, all the remaining stamps from that zone are unlocked in the app. One can add as many or remove as many stamps from his own collection at any time. The goal is to find and collect all the stamps around the museum.

After the visit to the museum, one can continue to take pictures of stamps they find at home and the app will be able to identify them, give information to them from the archive, and add them to their virtual collection. The account created with the app will also be a login to the BPMA's website where one can see all the stamps they collected on a desktop. The app and website then link with all content and one can build their virtual collection from anywhere around the world, and it all started within the museum with our app.

Motivation

An app must successfully intrigue audience members. We recommend that the BPMA include a "new technology" in their app. Mobile apps that provide unique experiences are more

attractive. For example, the James May app used image recognition to offer an interesting augmented reality experience. Having this type of innovative technology arouses curiosity. Therefore, the BPMA should consider introducing a technology that has the novelty factor. The prototype that we created uses image recognition as the motivating factor. This technology drives the innovative idea of virtual stamp collecting.

The BPMA should promote the app through their social media streams and in their new museum. It would also be a great opportunity to advertise the app with the opening of the new center.

Engagement

Successful mobile apps offer features that capture the attention of the users and cause the users to use the app again. We recommend that the BMPA implement an app with varied content such as quizzes, trivia, and user comments. These activities are effective ways to engage users. Although a variety of features improves user engagement, the app should avoid overexposure of features. It becomes exhausting for the user to focus on too many actions and will eventually decide to stop using the app. We advise that the BPMA develop an interactive app by constantly prompting the user to participate. Our app proposal engages users by providing varied content (history, design, "Did you know?" fun facts) and the activity of virtual stamp collecting.

Content

Mobile apps use different strategies to provide access to their content. We recommend that the BPMA make their app free; however, they should include additional content for a small charge or under certain conditions, such as allowing users to unlock additional information about stamps by visiting the museum. Another alternative is to use the app to direct users to BPMA resources such as the online catalogue. Additionally, a coupon in the app could provide an incentive for visitors to use the café.

Using the results from the focus group and surveys, we determined that our target audience is interested in history, design, and printing history. In addition to including these categories of information, we noticed that having fun facts about each stamp would encourage app users to look for more information about the stamps. The app should also offer the feature of zooming in and out of each stamp in order to enhance the viewing experience.

Usability

Utility is the last category to consider when evaluating the app and it often determines the appeal of an app among many people. We recommend that the BPMA develop an app that is intuitive to use. Most people want to avoid the learning process involved with using something new. The app should feel easy to use and navigation should be comfortable. The BPMA should consider looking at Bytelight technology. This Bytelight app is completely automatic and encourages the user to explore its features. The BPMA could also consider the analytics software in Bytelight to help improve their museum experience.

A key factor in usability is that the technology in the app works. In our app prototype, it is required that the image recognition technology functions properly. This technology could go even further and allow users to use the app with their own stamps. However, in the event that the image recognition feature does not work, an easy alternative would be to place code numbers next to each stamp. It would be beneficial for the app to be available across multiple platforms in order to maximize accessibility to mobile users. The new museum center will offer many interactive stations in their exhibits; therefore, we decided that it would be better if users download the app to their own devices instead providing tablets at the entrance of the museum. This will improve the social mechanics of the gallery because many of the stations in the exhibits would require visitors to store the devices for the duration the activity. This impact on social mechanics is one of the reasons for disregarding Bytelight as an alternative for the BPMA.

Gallery Suggestions

When integrating a mobile to a museum exhibit, some considerations can improve user experience. If the BPMA decides to implement a mobile app, it is very likely that some content will require internet connection. Therefore, we suggest that the BPMA offer public Wi-Fi. This will provide a better experience to people who want to access online content, such as the catalogue or the museum website. The app prototype that we suggest would require blown up photographs of stamps placed along the museum walls.

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Appendices

Appendix A: Description of the British Postal Museum & Archive

The British Postal Museum & Archive (BPMA) was created in 2004 as the public identity for the Postal Heritage Trust. The Trust was established in order to provide access to collections from the previous National Postal Museum and to administer the public records of the Royal Mail Archive ("About the Collections", 2013). In 2005, the museum's website was used to provide digital access to a portion of the collection. This section of the website quickly became popular among philatelists. Stemming from the success of the digital collection, the museum has looked for other methods of communicating with their community in order to reach a greater number and variety of people. Starting in 2009, the museum began using social media, such as Facebook, Twitter, and Flickr, to attract a wider audience (Bean, 2012).

With these many changing modes of presentation, the BPMA has still stayed true to its mission and values. The British Postal Museum and Archive strives to better the communication and educational value of its collection as well as its services. The mission of the British Postal Museum and Archive reads: "British postal services helped to shape the modern world. We work to ensure that this human story of communication, industry and innovation is available and enjoyable for all." Looking to the future, the BPMA hopes to further improve access to the collection, form stronger partnerships with funding sources, guarantee an adequate organizational structure, and preserve its collections for future generations ("About the Collections", 2013).

Currently the British Postal Museum & Archive has facilities at three locations: The Royal Mail Archive in Clerkenwell, London, The Museum Store in Loughton, Essex, and the Museum of the Post Office in the Community located in Blist Hill Victorian Town, Shropshire. A map displaying the locations of the three facilities can be seen in Figure 8.

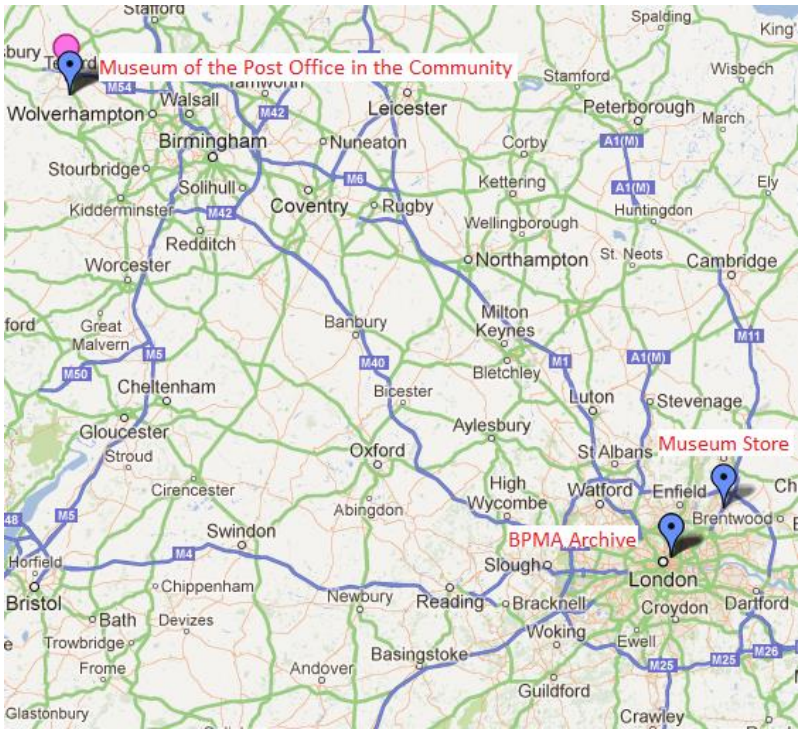


Figure 8: Map of BPMA Facilities

The Royal Mail Archive has a small area for the display of selected items from the collection. The displays are changed on a regular basis, but the space is too small to display many objects or any of the larger artifacts from the collection, such as vehicles. Thus, the Royal Mail Archive is primarily an archive housing the written records of the Royal Mail, the GPO and the Post Office, as well as photographs, posters, and stamps. The extensive collections of the archive fill over 2.5 miles of shelving ("About the Collections", 2013). The facility is free and open to the public, whether the purpose of the visit is to conduct research in the search room or view some of the items from the British Postal Museum & Archive's collection displayed in the small exhibition area ("Exhibitions & Events", 2013). The British Postal Museum Store is where the larger pieces of the collection are kept including letterboxes, vehicles, furniture, and sorting equipment. Now, the British Postal Museum & Archive has limited space to permanently display these large objects, so they are kept in Loughton until they are needed. The Loughton facility also stores paper materials that are not part of the official Public Record, such as song sheets and postcards that were not created by the Royal Mail Group and are not part of the official archive. Thus, the Museum Store is not so much a retail store, as the name might imply, but rather it is a storage facility, and an appointment must be made in order to view the exhibits ("About the Collections", 2013). Finally, the purpose of the Museum of the Post Office in the Community is

to educate the community on the role that postal communications have played in Britain throughout history. To tell this story and interest everyone, photographs, films, post boxes, uniforms, and even some vehicles are on display ("Exhibitions & Events", 2013).

As previously mentioned, the British Postal Museum & Archives does not currently have sufficient exhibition space available to display its extensive collection of postal artifacts from the archive or the Museum Store. Ironically, the BPMA has been unable to provide permanent access to their stamp collection, which increases by around 500 pieces of stamp artwork every year. Although the collection of stamps was made available on the BPMA website in 2005, this is not necessarily common knowledge and a permanent display may appeal to a larger audience. In order to address this problem, the BPMA is planning to expand and build a new Postal Museum at Calthorpe House near the existing archive in Clerkenwell. This museum will display a selection of items from the collection including stamps, vehicles, employment records, and photographs dating back 400 years ("Calthorpe House", 2013).

The British Postal Museum & Archive hosts a large variety of exhibitions and events at various venues to make items from the collection more accessible to more people throughout Britain. In 2011, about 250,000 people visited a BPMA exhibition or display and around 14,000 people attended one of the public outreach activities of talks, tours, family days, and other events ("Impact Report", 2011). These events and exhibitions are held at locations across the country and are designed to interest more than just stamp collectors and philatelists. Some recent exhibitions include the "Designs on Delivery with Paintings in Hospitals" at the Great Western Hospital in Swindon and the "Last Post: Remembering the First World War" at the Museum of Army Flying in Hampshire. In order to make these exhibits more accessible to everyone, a majority of the current and past exhibitions are available for online viewing ("Exhibitions & Events", 2013).

In addition to the exhibits and events offered at various venues around the country, the BPMA also hosts events at its facilities in London, offers exhibits on loan, and conducts outreach programs in schools. For example, one of the talks held at the Phoenix place, next door to the BPMA Search Room, is "First Class: A History of Britain Told Through 36 Postage Stamps".

Exhibitions such as “The Post Office in Pictures” are available on loan, free of charge (“Exhibitions & Events”, 2013). While the “exhibitions for hire” are smaller in number than those hosted at venues around the country, they are still valuable resources. In addition to the exhibitions and events, the BPMA also makes a special effort to reach out to primary and secondary schools. In 2011, around 2,000 teachers and students participated in school workshops, including the Stamps in Schools program where a member of the BPMA staff visits a classroom to illustrate history using stamps and other materials from the collection. Additionally, 3,000 copies of BPMA’s ‘learning packs’ were given to teachers free of charge as hard-copy or online versions to be used as a resource in the classroom (“Impact Report”, 2011).

In an effort to widen its audience, especially among the younger generation, the BPMA has been expanding its use of social media as an outreach tool. Just in the past year alone, Facebook likes and Twitter followers have nearly doubled from 773 to 1500 and 1973 to over 300 respectively (“About the Collections”, 2013). Like many other museums, the BPMA realizes that it must maximize its use of digital technologies in general and the rapidly evolving social media in particular in order to meet the expectations of its increasingly technologically sophisticated audiences.

The BPMA achieves all of the above initiatives, even on a relatively small staff and funding. As of 2011, 39 paid employees and 30 volunteers staffed the BPMA facilities. The staff of the Postal Heritage Trust is structured under a team of managers. Figure 9 shows a detailed visual of the organization. The director, shown in blue in Figure 9, works with a management team (shown in pink) to oversee financial issues and current activities. The six other groups in chart are different task forces each responsible with addressing specific areas of the museum such as: curating, fundraising, exhibitions and social media.

The public identity of the Postal Heritage Trust is sustained on charitable acts. Most of the £1.65 in income is categorized as ‘voluntary contributions’, which includes major grants from the Royal Mail Group and the Post Office Ltd. The largest part of expenditures are classified as ‘charitable activities’, which refer to all expenses associated with maintaining and operating the archives and museum exhibitions, programs, and outreach activities.

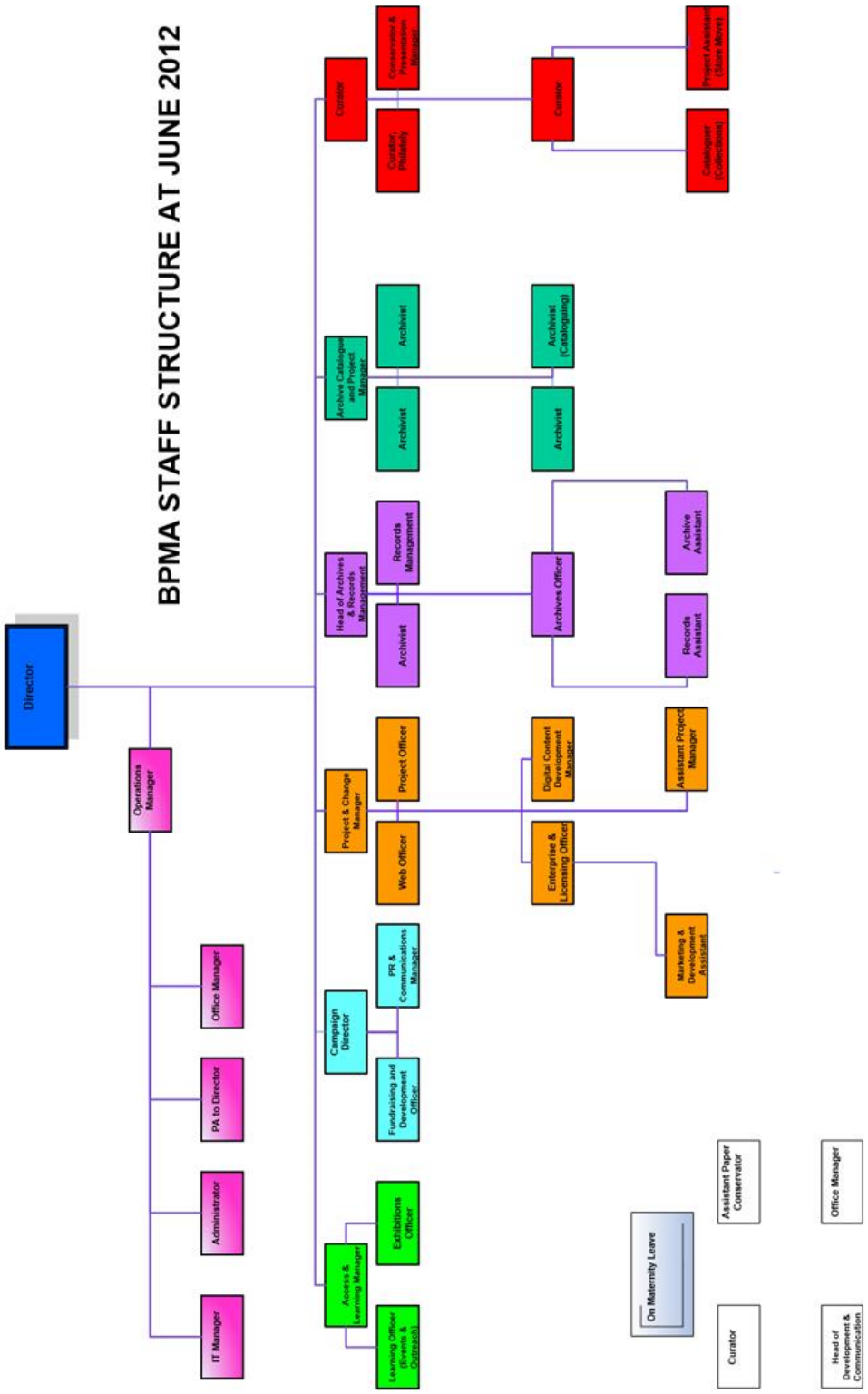


Figure 9: BPMA Organizational Structure

Appendix B: Interview Questions of Stakeholders

Preamble: We are students working in collaboration with the British Postal Museum & Archive to develop a proposal for the creation of a mobile device app that would display the stamp collection of the BPMA. One of our primary objectives is to find out more about the content in apps as well as how technology has been implemented alongside museum archives. May we have permission to publicly disclose your identity and/or responses? If no, we will honor all requests for anonymity and confidentiality, using pseudonyms if necessary. If yes, we would also offer you the opportunity to pre-approve the publication of any quoted material. We would like to ask you the following questions but are open to other questions and discussion as well:

- What content is offered to the audience in the apps showcasing digitised museum and archived collections?
- What are their methods for creating the content displayed?
- What payment model, if any, has been created for the app's content?
- What is the most creative way to use museum, archive, or library collections in apps?
- What are the greatest benefits to making content available in apps?
- How has the content and the apps themselves been received by the public?
- How they are able to appeal to such a variety of people?
- What other apps should we evaluate or who else should we interview on the subject?

Appendix C: Initial Survey Questions and Topics

Preamble: We are students working in collaboration with the British Postal Museum & Archive (BPMA) to develop a proposal for the creation of a mobile device app. This app will allow users visual access to the stamp collection of the BPMA. Before we can make any recommendations to the BPMA, we need to determine if the target audiences of the museum would be interested in this type of app which will be the focus of this survey. We will be describing the results of this research in the final report of our project, but will keep the names of all sources confidential. The only personal information we will be collecting is the age range that you fall into as well as your town and country of residence. This process is completely voluntary, so let us know if at any point you wish to stop answering questions or if you wish to skip a particular question. Do you have any questions before we begin?

1. What age bracket do you fall under?
    a. Under 15
    b. 15-24
    c. 25-34
    d. 35-44
    e. 45-54
    f. 55-64
    g. 65-74
    h. 75+

2. Where do you live?
    a. (town, country)

3. Do you own any of the following mobile devices?
    a. smartphone (iPhone, Android, Blackberry)
    b. tablet (iPad, iPod touch, etc)
    c. eBook reader
    d. I do not own any

4. Have you ever visited one of the BPMA locations? If so which one?
    a. Royal Mail Archive
    b. Museum Store
    c. Museum of the Post Office in the Community
    d. I have never been to any of the BPMA locations

5. Have you ever viewed the BPMA's stamp collection online? Why or why not?
    a. If yes, was there a particular collection that interested you, and why?

6. Do you currently collect stamps? (Y/N)
    a. If yes, when looking at stamps, what aspects interest you most?
        i. History/story behind the stamp
        ii. Design and quality of the image
        iii. Graphic design
        iv. Printing history
        v. Other (fill in)

    b. If no, if you were to look at stamps, what aspects do you think would interest you the most or what would you like to know more about?
        i. History/story behind the stamp
        ii. Design and quality of the image
        iii. Graphic design
        iv. Printing history
        v. Other (fill in)

7. If the BPMA were to develop a mobile device app to display their stamp collection, including essays (trial stamps), proofs, metal dies, printing plates, artwork, and issued and unissued stamps, would you want to download it if it had the following features: (check all that apply)
    a. Some content was free
    b. All content was free
    c. Included artwork
    d. Can be used in the museum
    e. General information about the BPMA
    f. Can virtually collect stamps
    g. Can share information with others
    h. Quizzes about stamps
    i. Game
    j. I would not download it
    k. Other (fill in)

Appendix D: App Content Survey

1. Looking at this common stamp, what content do you already know about it, if anything?
    a. What more information would you like about it?
    b. Is there anything about it that you are particularly interested in?
2. Looking at this rare stamp, what content do you already know about it, if anything?
    a. What of the following would most interest you about it:
        i. what makes it rare
        ii. the history behind the stamp
        iii. how it was designed
    b. What else you be interested in learning about this stamp?
3. Looking at this trial stamp that was never distributed, what content do you already know about it, if anything?
    a. What of the following would most interest you about it:
        i. why the stamp was never distributed
        ii. the history behind the stamp
        iii. how it was designed
    b. What else you be interested in learning about this stamp?

Appendix E: Interview with Philatelists

Preamble: We are students working in collaboration with the British Postal Museum & Archive (BPMA) to develop a proposal for the creation of a mobile device app. This app will allow users visual access to the stamp collection of the BPMA. Before we can make any recommendations to the BPMA, we need to determine if the target audiences of the museum would be interested in this type of app. We would like to ask you a few questions regarding what content a stamp enthusiast or philatelist would want featured in the app. We will be describing the results of this research in the final report of our project, and would like to include your name with your permission. This process is voluntary, so let us know if at any point you wish to stop answering questions or if you wish to skip a particular question. Do you have any questions before we begin?

- Do you have a stamp collection? (If yes, ask following questions)
    - How large is your collection?
    - How do you organize your collection?
    - What information are you missing that you would like to add to your collection?
    - What key information do you generally want about your stamps?
    - Where do you get information for your stamp collection?
    - What motivates you to collect stamps?
- Do you belong to a philatelist society?
- What interests you in stamps and postal history?
- Have you used the BPMA resources before?
    - If so, what is the primary reason for your visit?
- Have you viewed the BPMA's stamp catalogue in person or online? Please specify which.
    - What information do you look for from either source?
    - What are you particularly interested in?
    - If you have visited the website before, are there any features you feel are missing that you would like included?
- Would you be interested in this app?
    - What content would you like to see included in the app?
    - What features, if any, would motivate you to use the app?
    - Do you have a mobile device? If so, ask to specify what they use.
    - Would you download it on your own mobile device or would you prefer to use it at the BPMA's new museum?

Appendix F: Evaluation of Prototype

Preamble: We are students working in collaboration with the British Postal Museum & Archive (BPMA) to develop a proposal for the creation of a mobile device app. This app will allow users visual access to the stamp collection of the BPMA. Before we can make any recommendations to the BPMA, we need to determine if the target audiences of the museum would be interested in this type of app. We have developed a prototype, and were wondering if you would be willing to try navigating through the app for about 5 minutes. Additionally, we would like to ask you a few follow up questions for about 5-10 minutes after you have experimented with the prototype. These questions will regard your assessment of our prototype and any improvements that you think we should make. We will be describing the results of this research in the final report of our project, but will keep the names of all sources confidential. The only personal information we will be collecting is the age range that you fall into as well as your town and country of residence. This process is completely voluntary, so let us know if at any point you wish to stop answering questions or if you wish to skip a particular question. Do you have any questions before we begin?

Questions:

- How old are you?
- Where are you from?
- What do you currently use for apps and other technologies (computer?)
- Would you want to download the app? Why / Why not?
- What about the app would make you want to download it?
- Is there anything that could be added to improve the app / something you were expecting?
- Was there anything in the interface that you felt wasn't necessary?
- Did you ever have to stop for a while to think about what to do next? If yes, why?
- Is there anything else you would like to mention about the app?

Appendix G: Criteria for App Evaluations

List of Qualitative Questions:

- How old are you?
- Where are you from?
- What do you currently use for apps and other technologies (computer?)
- How did you first hear about the app?
- How did you get the app? (in museum, download, etc.)
- What about the app made you want to use it / download?
- Is there anything that could be added to improve the app / something you were expecting?
- Was there anything in the interface that you felt wasn't necessary?
- Did you ever have to stop for a while to think about what to do next? If yes, why?

List of Quantitative Criteria:

1. Ease of Navigation
2. Level of Interaction
3. Clear Communication of Content
4. Visual Elements
5. Media Elements
6. Age appropriateness
7. Level of Entertainment
8. Accessibility
9. Relevance
10. Motivation

Standardized Mobile Application Evaluation Metrics

1. Ease of Navigation

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Did as expected	Every action performed did not do what you expected	Few times did the action performed do as you	Half of the time, an action performed	Most times the action performed did as you	Every action performed generated the expected

	it to	expected	responded the way you expected it to	expected	response
Able to find content	Was unable to find content you wanted.	Few times did not have trouble finding content.	Half the content was easy to find / half the content you had trouble finding.	Few times had trouble finding content.	Had no trouble finding all content you wanted.
Navigation was natural	The navigation did not work at all how you thought it would	Few times did the navigation work as you thought it would	Half of the navigation worked as you thought it would	Few times did the navigation not work as you thought it would	The navigation worked exactly how you thought it would

2. Level of Interaction

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
User interaction	No user input	Few times the app had user input	Half of the app is user input / half of the app is not user input	Few times the app did not have user input	All user input
Connection to other users	No communication/interaction with other users	Little communication/interaction with other users	Half of the app is communication /interaction with other users	Most of the app is communication/interaction with other users	All aspects of the app is communication /interaction with other users

External content (ie exhibit)	Not dependent on content from exhibit (eg game inside of app)	Not very dependent on content from exhibit	Half is dependent/not dependent on content from exhibit	Highly dependent on content from exhibit	Completely dependent on content from exhibit (eg controls the exhibit)

3. Clear Communication of Content - is the content getting to the user?

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Understanding	Content is entirely confusing	Some content is clear	Half content is clear / half content is confusing	Most of the content was easy to understand	Content/descriptions were easy to understand
Content Format	Formatting makes no sense	Little of the formatting makes sense	Half of the formatting makes sense	Most of the formatting makes sense	Formatted in a way that makes complete sense

4. Visual Elements

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Identifiable design elements	None of the design elements match the	Few of the design elements match the	Half of the design elements match the	Few of the design elements do not match the	All design elements match the museum

	museum branding	museum branding	museum branding	museum branding	branding
Attractive	None of the design elements are aesthetically pleasing	Few of the design elements are aesthetically pleasing	Half of the design elements are aesthetically pleasing	Few of the design elements are not aesthetically pleasing	All design elements are aesthetically pleasing
Icons that make sense	None of the buttons and icons are known standards.	Few of the buttons and icons are known standards.	Half of the buttons and icons are known standards.	Few of the buttons and icons are not known standards.	Every button and icon is a known standard.
Visuals not distracting	All of the visual formatting of the app is distracting.	Little of the visual formatting of the app is not distracting.	Half of the visual formatting of the app is distracting.	Little of the visual formatting of the app is distracting.	None of the visual formatting of the app is distracting and it adds to the experience.

5. Media Elements (add another column (N/A)) - Influence to the experience. (1 completely detracts/halts experience vs. 5 completely improve/adds to the experience)

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary	N/A
Ads/popups	All of the ads are distracting	Few of the ads are not distracting	Half of the ads are distracting	Few of the ads are distracting	None of the ads are distracting	There are no ads present in the app.

Videos, audio tours, etc.	All of the videos or audio tours are distracting and take away from the exhibit.	Few of of the videos or audio tours not are distracting and do not take away from the exhibit.	Half of the videos or audio tours are distracting and take away from the exhibit.	Few of the videos or audio tours are distracting and take away from the exhibit.	None of the videos or audio tours are distracting and take away from the exhibit.	The app does not use videos, audio tours, etc.
Social Media	None of the social media features in the app are enhancing the app experience	Few of the social media features in the app are enhancing the app experience	Half of the social media features in the app are enhancing the app experience	Most of the social media features in the app are enhancing the app experience	All the social media features in the app are enhancing the app experience	The app does not offer interaction with social media (e.g. Facebook, Twitter, etc.)

6. Age appropriateness
    a. Select which age groups: Kids, Teenagers/Young Adults, Adults, Elderly
7. Level of Entertainment
    a. 1 boring, 5 fun

8. Accessibility - How accessible is the app

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Awareness	Had no knowledge that the app existed.	Had heard of app but did not have knowledge about its	Had heard of app, knew only about its purpose.	Knew that the app existed and about its purpose, but had little	App was well advertised, knew that it existed, its purpose, and

		content or purpose.		knowledge about its contents	its contents.
Access	Could not find a way to download the app or use it in the museum	Had many difficulties downloading the app or finding mobile devices to use in the museum	Average difficulty in downloading the app or finding mobile devices to use in the museum.	Had few difficulties downloading the app or finding mobile devices to use in the museum.	Had no difficulties downloading the app or4 finding mobile devices to use in the museum

9. Relevance - Is the content relevant to the exhibit

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Enhancing museum experience	None of the app content is enhancing the museum experience	Little of the app content is enhancing the museum experience	Half of the app content is enhancing the museum experience	Most of the app content is enhancing the museum experience	All of the app content is enhancing the museum experience
Duplicate content	The content in the app is exactly the same as in the exhibit	Most of the app content is the same as the exhibit's content	Half of the app content is in addition to the exhibit's content	Most of the app content is in addition to the exhibit's content	All of the appcontent is in addition to the exhibit's content
New Information	You know all of this information already	Most of the information is not new to you	Half of the information is new to you	Most of the information is new to you	All of the information is new to you

Content up to date	All content is old information that is not updated frequently	Most of the content is not updated frequently with new information	Half of the content is updated frequently with new information	Most of the content is updated frequently with new information	All content is updated frequently with new information

10. Motivation

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Initial urge to use app	Do not want to use the app	Not very interested in using the app	Moderately interested in using the app	Somewhat interested in using the app	Extremely interested in using the app
Desire to use app again	Do not want to use the app again.	Not very interested in using the app again	Moderately interested in using the app again.	Somewhat interested in using the app again	Extremely interested in using the app again

[name]

[date went to museum]

Age: Where I am from:

Museum Has Internet?	☐

Content requires internet?	☐

1 Ease of Navigation	
did as expected	1
find content	1
navigation was natural	1
Average	**1.00**

2 Interaction	
user interaction	1
connection to other users	1
external content	1
Average	**1.00**

3 Communication of Content	
understanding	1
format	1
Average	**1.00**

4 Visual Elements	
branding	1
pleasing/attractive	1
icons	1
not distracting	1
Average	**1.00**

5 Media	
pop-ups	1
videos/audio tours	1
social	1
Average	**1.00**

6 Age	
Children	☐
Teenagers	☐
Adults	☐
Elderly	☐

7 Entertainment	
how fun it is	1.00

8 Accessibility	
awareness	1
access	1
Average	**1.00**

9 Relevant to exhibit	
getting more from exhibit	1
duplicate information	1
new information	1
up to date	1
Average	**1.00**

10 Motivation	
urge initially	1
want to use	1
Average	**1.00**

OVERALL SCORE	**1.00**	
Best Category	1 Ease of Navigation	1.00
Worst Category	1 Ease of Navigation	1.00

Describe the app (what device used, general description):

How do you get the app (in museum, download, etc.)?

What would make you use the app?

Is the app missing something you were expecting?

Is there anything that could be added to improve the app?

Was there anything in the interface that you felt was not necessary?

Did you ever have to stop for a while to think about what to do next? If yes, why?

What do you currently use for apps/technology?

Appendix I: Criteria for Museum Digital Experience Evaluations

List of Qualitative Questions:

- Description: (game, sit down, group exhibit, etc.)
- What do you use to navigate? (ie. touch-screens, keyboards, etc.)
- How old are you?
- Where are you from?
- Have you been to any other memorable technology related activities at museums?
- Why did you approach this technology related activity?
- What about the activity would make you want to use it again?
- Is there anything that could be added to improve the activity / something you were expecting?
- Was there anything in the interface that you felt wasn't necessary?
- Did you ever have to stop for a while to think about what to do next? If yes, why?
- Did you have any trouble at all with the activity?

List of Quantitative Criteria:

1. Ease of Navigation
2. Level of Interaction
3. Clear Communication of Content
4. Visual Elements
5. Media Elements
6. Age appropriateness
7. Level of Entertainment
8. Accessibility
9. Relevance
10. Motivation
11. Instructions

Standardized Museum Digital Experience Evaluation Metrics

1. Ease of Navigation

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary

Did as expected	Every action performed did not do what you expected it to	Few times did the action performed do as you expected	Half of the time, an action performed responded the way you expected it to	Most times the action performed did as you expected	Every action performed generated the expected response
Able to find content	Was unable to find content you wanted.	Few times did not have trouble finding content.	Half the content was easy to find / half the content you had trouble finding.	Few times had trouble finding content.	Had no trouble finding all content you wanted.
Navigation was natural	The navigation did not work at all how you thought it would	Few times did the navigation work as you thought it would	Half of the navigation worked as you thought it would	Few times did the navigation not work as you thought it would	The navigation worked exactly how you thought it would
How responsive was the navigation to your input	The interface did not respond at all to input	Few times did the interface respond to input	The interface did not respond / did respond half of the time	Few times did the interface not respond to input	The interface responded to every input instantly

2. Level of Interaction

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
User content	No user input	Few times the app had user	Half of the app is user	Few times the app did not	All user input

		input	input / half of the app is not user input	have user input	
Connection to other users in interface	No communication/interaction with other users	Little communication/interaction with other users	Half of the app is communication/interaction with other users	Most of the app is communication/interaction with other users	All aspects of the app is communication/interaction with other users
Connectedness to other stations in the exhibit	None of the content is related to other stations in the exhibit	Little of the content is related to other stations	Half the content is related to other stations	Little of the content is not related to other stations	All content is completely related to other stations
Group orientation	There is no group experience	Little of the content is group oriented	Half of the content is group oriented	Most of the content is group oriented	All content is group oriented

3. Clear Communication of Content - is the content getting to the user?

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Understanding	Content is entirely confusing	Some content is clear	Half content is clear / half content is confusing	Most of the content was easy to understand	Content/descriptions were easy to understand
Content Format	Formatting makes no sense	Little of the formatting makes sense	Half of the formatting makes sense	Most of the formatting makes sense	Formatted in a way that makes

					complete sense

4. Visual Elements

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Identifiable design elements	None of the design elements match the museum branding	Few of the design elements match the museum branding	Half of the design elements match the museum branding	Few of the design elements do not match the museum branding	All design elements match the museum branding
Attractive	None of the design elements are aesthetically pleasing	Few of the design elements are aesthetically pleasing	Half of the design elements are aesthetically pleasing	Few of the design elements are not aesthetically pleasing	All design elements are aesthetically pleasing
Icons that make sense	None of the buttons and icons are known standards.	Few of the buttons and icons are known standards.	Half of the buttons and icons are known standards.	Few of the buttons and icons are not known standards.	Every button and icon is a known standard.
Visuals not distracting	All of the visual formatting of the app is distracting.	Little of the visual formatting of the app is not distracting.	Half of the visual formatting of the app is distracting.	Little of the visual formatting of the app is distracting.	None of the visual formatting of the app is distracting and it adds to the

					experience.

5. Media Elements (add another column (N/A)) - Influence to the experience. (1 completely detracts/halts experience vs. 5 completely improve/adds to the experience)

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary	N/A
Ads/popups	All of the ads are distracting	Few of the ads are not distracting	Half of the ads are distracting	Few of the ads are distracting	None of the ads are distracting	There are no ads present in the app.
Videos, audio tours, etc.	All of the videos or audio tours are distracting and take away from the exhibit.	Few of of the videos or audio tours not are distracting and do not take away from the exhibit.	Half of the videos or audio tours are distracting and take away from the exhibit.	Few of the videos or audio tours are distracting and take away from the exhibit.	None of the videos or audio tours are distracting and take away from the exhibit.	The app does not use videos, audio tours, etc.
Social Media	None of the social media features in the app are enhancing the app experience	Few of the social media features in the app are enhancing the app experience	Half of the social media features in the app are enhancing the app experience	Most of the social media features in the app are enhancing the app experience	All the social media features in the app are enhancing the app experience	The app does not offer interaction with social media (e.g. Facebook, Twitter, etc.)

6. Age appropriate

a. Select which age groups: Kids, Teenagers/Young Adults, Adults, Elderly

7. Level of Entertainment
    a. 1 boring, 5 fun

8. How accessible is the experience

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Easy to locate experience	Could not locate the station in the museum.	Had great difficulty locating station in the museum	Had moderate difficulty locating station in the museum	Had little difficulty locating station in the museum	Had no difficulty locating station in the museum, found it easily.
Physical access	Targets only one specific group of people to use	Few groups of people would be abot to use this	Half of users at the museum will be able to use this	Few groups of people would not be able to use this	Anyone can use the space

9. Is the experience relevant

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Enhancing museum experience	None of the content is enhancing the museum experience	Little of the content is enhancing the museum experience	Half of the content is enhancing the museum experience	Most of the content is enhancing the museum experience	All of the content is enhancing the museum experience
New	You know all of this	Most of the information is	Half of the information is	Most of the information is	All of the information is

Information	information already	not new to you	new to you	new to you	new to you
Content up to date	All content is old information that is not updated frequently	Most of the content is not updated frequently with new information	Half of the content is updated frequently with new information	Most of the content is updated frequently with new information	All content is updated frequently with new information

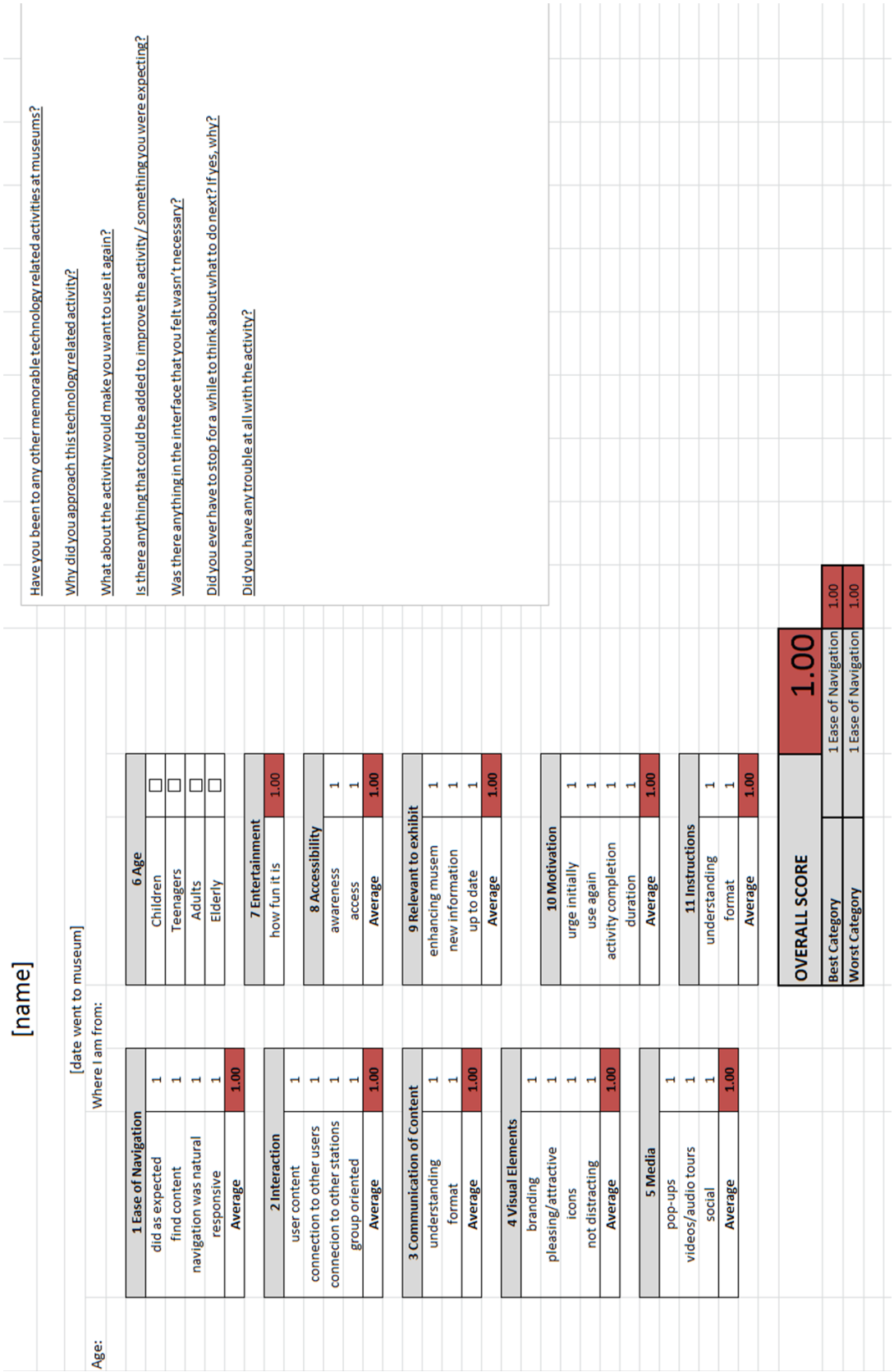
10. Motivation

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
Initial urge to use	Did not want to use the activity	Not very interested in using activity	Moderately interested in using the activity	Somewhat interested in using the activity	Extremely interested in using the activity
Desire to use again	Do not want to use it again.	Not very interested in using it again	Moderately interested in using it again.	Somewhat interested in using it again	Extremely interested in using it again
Activity Completion	Gave up and stopped using the activity	Completed little of the activity	Completed about half of the activity	Completed most of the activity	Completed the entire activity
Duration of stay	Left much earlier than expected	Spent a little less time than expected	Spent exactly the amount of time initially expected	Spent a little more time than expected	Stayed much longer than expected

11. Instructions

Criteria	1 - Poor	2 - Fair	3 - Average	4 - Good	5 - Exemplary
How understandable were the instructions	None of the instructions made any sense	Few of the instructions made sense	Half of the instructions made sense	Most of the instructions made sense	All of the instructions made sense
Could you understand how to use it without instructions	Absolutely needed instructions to use the activity	Little of the activity was understandable without instructions	Half of the activity was understandable without instructions	Most of the activity was understandable without instructions	Instructions were not necessary to understand the activity

Appendix J: Sample Evaluation Sheet for Museum Digital Experience Evaluations



[name]

[date went to museum]

Age:

Where I am from:

1 Ease of Navigation	
did as expected	1
find content	1
navigation was natural	1
responsive	1
Average	1.00

2 Interaction	
user content	1
connection to other users	1
connecion to other stations	1
group oriented	1
Average	1.00

3 Communication of Content	
understanding	1
format	1
Average	1.00

4 Visual Elements	
branding	1
pleasing/attractive	1
icons	1
not distracting	1
Average	1.00

5 Media	
pop-ups	1
videos/audio tours	1
social	1
Average	1.00

6 Age	
Children	☐
Teenagers	☐
Adults	☐
Elderly	☐

7 Entertainment	
how fun it is	1.00

8 Accessibility	
awareness	1
access	1
Average	1.00

9 Relevant to exhibit	
enhancing musem	1
new information	1
up to date	1
Average	1.00

10 Motivation	
urge initially	1
use again	1
activity completion	1
duration	1
Average	1.00

11 Instructions	
understanding	1
format	1
Average	1.00

OVERALL SCORE	1.00
Best Category	1 Ease of Navigation 1.00
Worst Category	1 Ease of Navigation 1.00

Have you been to any other memorable technology related activities at museums?

Why did you approach this technology related activity?

What about the activity would make you want to use it again?

Is there anything that could be added to improve the activity / something you were expecting?

Was there anything in the interface that you felt wasn't necessary?

Did you ever have to stop for a while to think about what to do next? If yes, why?

Did you have any trouble at all with the activity?

Appendix K: Notes from Interviews with Museum Stakeholders

Miriam Ledley from the Boston Science Museum

March 5th, 2013: Byte Light

All information here is from an informal discussion with Miriam Ledley, who works with the visitor experience aspect and content of the Computer Science Exhibition space at the Boston Science Museum.

- First of its kind Museum App:
    - (from http://www.bytelight.com/) Each ByteLight has an identifier (similar to a MAC address). It broadcasts this identifier through the light itself – kind of like Morse code, but through light. A smartphone/tablet device demodulates the visible light signal via the existing cameras. The mobile device then consults a cloud-based server, which maintains an association of light identifiers, content, and physical location.
- How ByteLight started in the British Science Museum
    - ByteLight shared information with the Museum and asked if they could prototype.
    - The Computer Science exhibition was very interested in trying out the technology and software
    - The installation of the ByteLights, software, and purchase of iPads occurred in August of 2012
    - The original purpose was to see where visitors were going and to help them find their way with a map display on the iPad.
- Content Generation
    - The museum did not survey audiences ahead of time for what interested them in terms of content
    - Originally the app was set up as a map
        - The museumgoer would walk around to different regions of the exhibit and notice that the map changed to show their current location
        - Once the museumgoer entered a region, they must click on their current location to see information on that portion of the exhibit
    - For each region of space in the exhibit, the exhibit staff created a webpage with content to display on the iPad
        - Content ranged from questions, instructions/explanations, pictures, quizzes, and links to external websites

        - The exhibit staff tried many different variations of content to see what worked best
            - The goal was to keep people immersed in the activities in the exhibit and the iPad would act as an aid to the exhibit
            - Change directions/content for each location so people will not get bored and continue to interact with exhibits
    - After one explored the exhibit with the iPad, the individual and the exhibit staff would discuss their experience
        - This was the only survey of museumgoers: an informal dialogue on what worked and what did not work in the app
- Changes made throughout the prototype
    - The first month, the exhibit staff went to developers weekly to make changes to make app easier to use
    - Changed from the initial "map" view to now have content just pop up on the screen
        - This change meant less clicking and a much more immersive experience for the user
    - No longer instruct users on how to use the app – should be understood from as soon as put in the museumgoers hands
        - Never tell a user how to use the app, let them explore
        - Always focus on getting the user to the content faster
        - Less is often more in terms of apps.
    - In process of putting survey in app
    - To fully test the app and develop the prototype the museum requires a year to a year and a half testing
- Audience Evaluations
    - Eventually going to survey to see what the visitors like à mostly parents because need kids require parental consent to talk to
    - Ask adult visitors where they would want this app to be used and if they would use it
        - What do you like about the app?
        - What do you want in the app?
        - What do you not want to go away from the app?
    - The exhibit staff watched the museumgoers as they walked around the exhibit to see if they had any trouble
    - The ByteLight Software has a traffic heat-map
        - Displays which portions of the exhibit floor have the heaviest foot traffic or the most time spent
        - Can show places in the exhibit that are popular
        - Shows where the app is used most, and which exhibits are visited the most

- Responses from museumgoers
    - Most think that ByteLight is really cool
    - ByteLight should be used more and in other places too: grocery stores
    - Helpful when an activity is confusing or instructions are not clear
    - Made the exhibit space more engaging – wanted to explore every different region to see what the app would do next
    - Greater and clearer content of the museum as a whole
    - Finding way around museum is very helpful
    - Different groups can get different things out of it – dynamic for different audiences
        - Content can be different for children or for specialists
        - A catered museum experience for different audiences
- Expansion – the app is successful
    - Looking to install ByteLight in the rest of the blue wing
        - Will probably take 1.5 years
    - Eventually want to use it in the entire building

Jack Ashby from the Grant Museum

March 12th, 2013: QRator App

All information here is from an informal discussion with Jack Ashby, the Museum Manager of the Grant Museum of Zoology in University College London.

- What is QRator?
  - (from http://www.qrator.org/about-the-project/what-is-qrator/) QRator allows visitors to type in their thoughts and interpretations of museum objects and click 'send'. Their interpretation becomes part of the object's history and ultimately the display itself via the interactive label system to allow the display of comments and information directly next to the artifacts.
  - (from http://www.qrator.org/about-the-project/what-is-qrator/) Powered by Tales of Things technology, developed at UCL's Centre for Advanced Spatial Analysis, the project has developed a method for cataloguing physical objects online that could make museums and galleries a more interactive experience. QRator takes the technology a step further bringing the opportunity to move the discussion of objects direct to the museum label and onto a digital collaborative interpretation label, users' mobile phones, and online allowing the creation of a sustainable, world-leading model for two-way public interaction in museum spaces.
  - Internet access is necessary as QRator posts to Twitter accounts
  - Not guided app: leave visitors to wander through the museum
    - Most guiding that they do is give a list of the top 10 objects in the museum
  - QRator.org offers the same experience as the app
    - Can see headline, question, introduction, and a picture of the case
- How QRator started in the Grant Museum of Zoology
  - The museum originally wanted electronic labels to change what they said for different museumgoers: scientific names for specialized audiences, less descriptive names for school children
  - Found QRator and changed interest to "user generated content"

        - People can tag object with QR code and tell their own story or comment on the object
    - Built custom iPad mounts out of metal, and purchased iPads
    - iPad Stations installed at 10 locations around the museum – cannot be moved
- Initial Reactions to the app
    - Scanning QR codes was cumbersome and unnecessary, just added to the complexity of the app
    - Limited number of opinions from visitors for each museum object
    - People's thoughts on an object might not be interesting
    - Did not stimulate the experience in the museum
- Changes made to the app
    - Ask questions initially to stimulate the conversations on the app – visitors can respond with answers and other comments
        - Most questions are delicate subjects that one often has a strong opinion
        - Format: headline, question, 60 word description
        - Comments go live as they are entered
            - Filtered for expletives
    - Questions were altered every 2 or 3 months
        - Amount of visitor comments did not change, so questions aren't changed as frequently now
- Pros of the app
    - A lot of interpretation has to be done regarding what visitors are actually saying
        - Time consuming process
    - Quality comments are useful to museum staff for future development of exhibits and informed the staff of changing interests of the public
    - All demographics and all ages use the app
- Cons of the app
    - The app is slow at posting the comments
    - No spell check
    - Every comment is reviewed by the museum staff
        - Time consuming, can have bad comments up on the feed for a period of time
        - Interpretation of the comments can be difficult
        - Some witty comments may be different than what one was expecting
        - Visitors don't always understand that staff can see their comments
    - Responses are unbalanced, some questions have more than others
    - New questions are generated on average every 3 months
        - Some questions must be asked, and stick around longer
    - Hardware Limitations
        - The metal cases blocked Wi-Fi access

        - iPad hardware updates happen so rapidly that new iPads must be purchased regularly
    - Software Limitations
        - New iPad software changed settings on the app without informing anyone
            - Now, the iPads must be turned on every half hour and the app restarted
- General museum evaluation
    - QRator does not track demographic use, but appears to appeal to all audiences
    - Future ideas: video comments
    - Also want to do more straight forward user evaluations
    - Commenting or use of QRator.org just does not happen
        - Only use of QRator happens on-site, at the museum

Carin Grix from the London Science Museum

March 25, 2013 – Carin Grix, Senior Licensing Manager of SCNG Enterprises

- Receives 2-3 app proposals a month, most are not viable
    - There is no budget for apps, and they are only viable if on a 30% revenue split
        - Provide funding company with access to collection and content from curators
- James May's Science Stories App
    - Funded by Qualcomm
        - Wanted to show latest software (image recognition paired with augmented reality of 3D models) developed at a well-known institution
        - Entire project cost over £70K
        - Process
            - Submitted use of software
            - Contact with James May's agent
            - Developer created a 3D model avatar
    - For the original goal, the project did not deliver
        - Originally supposed to be on object recognition
            - Visitor would hold mobile device up to object in exhibit and James May would walk around object and talk
            - Objects were not a good enough trigger
                - Had no distinct features that would work
                    - Idea to put green circles on all of the objects
                    - Decided it would be a bad idea to change gallery and famous, old for an app.
            - Lighting was not good for that formatting
                - Again, could not change gallery for that one app

        - App works well now, but some have complained that the movement to place device in front of the stand was not natural and was uncomfortable
    - One of the top 500 apps internationally
    - James May
        - Idea to involve him was pitched by the developer
            - Museum agreed because he would appeal to kids as well as women
                - Core audiences are school children, and younger children who are accompanied by women more often than not
    - Evaluation of app
        - Those interested in technology were blown away by the app
        - Those that were not as interested in technology found some of the issues previously mentioned to be very inconvenient
        - Successful in terms of revenue, but not as successful as they would have wanted
        - PR for the app has been great
        - Does the app improve the visitor experience?
            - Always the aim, but hard to tell in this case
            - As an app user, if it's useful and doesn't take too much data to download, consider that an improved experience
            - Fun to do → keeps kids quiet and engaged
            - Prohibitive → free museum and free experience, but have to pay £2.99 for the app
                - Considered a lot of money for an app
            - Have not completed questionnaire, not a priority for the museum
                - Focus instead on how much money was spent in the shop for example
            - Considered making a premium experience for the app
                - Difficult to set up because a lot of the museum is funded by external companies
                    - Ex: can't provide coupons for café because café is funded by another company
                - Great idea for smaller museums
                    - Ex: Limited edition stamps version of an app
- Working on a new Preschool app
    - Set to be released on May 24, 2013
    - Most kids that visit are secondary school aged (7-12) but often come with younger siblings
    - Small exhibit at the moment for these kids
    - App will provide games that will also teach young children about science in a fun way

- Audiences
    - Tap into Trade Publications
        - Obtain more information about audience
            - Ex: age group of stamp collectors
        - Use this info for the National Rail Museum (client)
            - Not a very “techie” audience
    - Science Museum has a clear branding and audience
        - Know their audience well enough to not have to conduct surveys before creating an app for example
        - Evaluate core brand value when creating things
            - Ex: everything has to be educational
    - Tricky to evaluate kids and families as well as enthusiasts
        - Kids can pick up on interests of others (ex: grandfather’s stamp collection) but need something fun to pull them in
            - Quizzes or puzzles

Kayte McSweeney from the London Science Museum

March 22, 2013

- Visit some museums that focus on school groups
    - Museum of London
    - National Maritime Museum
- Use apps to engage visitors, don't just throw information at them
- By the end of the next week, narrow down the audience to focus on for the app, can't please everyone
    - Speak to BPMA stakeholders
    - Come in with agenda for following Wednesday
- Concept creation
    - Who the app is for, why they want to use apps, what the app is for, interpret content, testing, design brief, and then hire a designer
- Research how different groups use mobile interpretation
- Successful app
    - Engagement/involvement, usability, and motivation
        - All are connected
    - Content has to be biggest piece
        - Potential to retain information (learn) is increased if you have everything working together
        - Try to have all elements at the same level
            - Could be fun but content might be lost because not at the same level
                - Ex: a game
- Strategy for surveying
    - Open, qualitative
    - Evaluation of aims and objectives beforehand, why testing
    - Top of the head answers, first things that come to mind
    - Ask same questions in different ways to ensure answers are accurate representations
    - Ask if there is anything else at the end
    - Analyze behavior
    - Don't always take what they say literally, read between the lines

Julian Wellek from the London Film Museum

April 15, 2013

- Device is multilingual
- Actively developing
- Issues
    - Needs to be updated frequently
    - More flexible so content can be changed and added
    - These issues have been fixes, but he could not go into details of the solution
- Using the app
    - Opening screen, can enter your email address or skip to the content of the app
    - Scan the QR code at various exhibit spaces
    - Content
        - Content written for them
        - Exhibit description
            - There is not a lot of text in the museum since it is a small space
            - More details in app than exhibit, fuller experience with the app
        - Picture/movie poster
        - Quiz
            - Multiple choice
            - Send the results back to reception
                - Helpful for when school groups visit
            - Developing different quizzes for each exhibit
        - Pictures, video, audio
        - Actor, photographer, and director categories
    - iPads are passed out in museum, looking to make version for iPod and Android
    - Go through, discover QR codes, and experience the museum
        - Data isn't made available until QR code is read
- Developing the app for other museums
    - Not all have wifi, have come up with a solution for that problem
    - Developed as open-ended as possible, tailor to different uses
    - Triggered by QR Codes
        - Lighting is different in every exhibit, rewriting some QR codes to ensure accuracy
- No audience analysis
    - Idea from the founder of the museum
    - Content based on what they knew audiences would like from experience
- Developed in 3-4 months, launched in April 2012
    - Version 2 will be released in a few months
        - Developed so other museums could use it as well
- Prototyping
    - Designer
    - Not concerned with left-hand, right-hand usability differences
    - Simple
        - Simplicity is key when you have a wide variety of audiences
        - Consider creating a layout specifically for kids at some point

        - the current versions are targeted more at adults
    - Testing amongst staff, no other audience
        - Accept feedback → couldn't divulge into what feedback they have received

Geoff Browell from the King's College London

April 19, 2013

- One of the few archives pushing forth on digital frontiers
- Nightingale app
    - Driven more by features on app than the story
        - Should be the other way around
    - Explore London as it would have been
    - Make archives more widely available in a fun way
    - Engage public in variety of ways
        - Cartoon that came to life
        - Choir songs
        - Augmented reality
        - Flexibility → can join route at any point
    - People don't generally use iPads out in the open → theft, could be dropped and broken
    - Wanted to incorporate social media, you can add content → work with history pin to do that now
- Working with national archives
    - Aim 25 → organization working to provide electronic access to archives in London
    - Wanted to do new things, made an app
- Need:
    - Reason for making app
    - strong story behind it
    - marketing plan → don't sell themselves
    - who's the audience?
        - General museumgoers, school children, adults
        - Worth it to make multiple versions to meet different needs?
- Don't take desktop experience and turn it into an app
    - Maps, navigation, something to do with where you are
- Archives are about stories
    - Also about networking
- Relate to youth, memories, and design qualities
    - Reaching to and attracting those audiences
- Tasks challenges, rewards
- Connect to communities in different ways
    - Ex: KCL stamps, attract attention at alumni events
- Have fun with it, engage people
- Crowds around exhibition, can't read the description
    - App gives that extra information
    - Practical, free or 99p, if not people will not be willing to pay
- Work with Centrescreen Production
    - Designers and storytellers
    - Great graphic designers

    - Personable and friendly, work with audiences
- Linking app content to different anniversaries
- Augmenting what you already have
    - People add facts and comments to the app
- Want to surprise people
- Display archive material digitally → get around the problem of preparing document and security for that display
    - Leaving with things → mememto that's more about the exhibit than something just from the shop
        - Pintrest for museums
- Many technologies are "less curator and more dictator"
    - Want to explore the museum in your own way
- Make visitors "work" for the experience, can't make it too easy
    - Learning is active
    - Go in and be challenged to learn

Appendix L: Notes from the Interview with Philatelist Richard West

April 5, 2013

- Interests in Stamps
    - Stamp collecting is all things to all men, what he finds interesting others may not
    - Particularly interested in design and printing
        - Artwork issues
        - Looking at the progression from ideas to the final stamp, or as far as the process goes
        - Printing techniques, interested in the more technical side
    - Others
        - Collect themes, design elements that cover their subject interests
            - Ex: aircraft
        - History of the postal service
            - When looking at an envelope, might be more interested in how the envelope got to its final location than in the stamp on it
- Stamp Collection
    - Can't really answer "how large" stamp collection is
        - Acquire a lot of material when given the opportunity so you don't miss out, then set that material aside until it eventually finds place in the collection or doesn't
    - Storage:
        - Stamps in collection usually mounted with a story line, design own pages
            - Not like children's stamp collections where the country name or subject is at the top of the page and you just place stamps there
        - Other collections in stock books or pockets
        - Often material is set aside in envelopes and boxes until they find a place for them
        - Difficult to quantify amount of stamps in collection
    - Finding Information for Collection
        - Some items you feel like you know all information available from catalogues or books
            - New information always comes along, either supplementing or correcting information you have already
            - Often an accidental process, more often than not
        - Others (i.e. staff members) make their own perceptions on what to put in catalogue, not always what a philatelist would want
            - Don't always appreciate the material the same way
        - Go through the archive to find material
        - Occasionally go online though the BPMA catalogue to do preliminary search then come to look at the physical collections

- Philips Collection online → read through the information he discovered, easier to view online
- Having the online catalogue is relatively new at the BPMA, and is a long and expensive process.

- Motivation
  - Difficult to define, some people are interested in collecting and some just aren't
  - Tough to figure out what exactly sparks the want to collect
  - Can't persuade someone to collect, it just comes to a person, sometimes later in life
    - If you have that trigger, you don't lose it
      - Some collectors stopped in 1999 before the new millennium
        - Started up again shortly after, collecting the stamps from the years they missed
    - Children often start collections, Richard began collecting at 8 years old as many from that time did, but can't be forced to collect
  - Sometimes start collecting other philatelic items instead
- Inheritance of Stamps
  - Didn't inherit his collection
  - Most collectors accept that they will either have to get rid of their collection before they die or leave detailed instructions for after
  - Often feel that if they pass it on it might not be appreciated or understood as well as the collector did
  - Children and grandchildren often do not take up the hobbies of their parents and grandparents
  - Donate to Museum
    - A lot of collectors have donated to the British Library, but a lot are not put on public display
      - Collection just locked away, hope that it is kept in good condition
        - Some airmail stamps were donated to the Science Museum, they let them rot away
      - Public domain, want to be able to make it available to everyone
- Philatelic Society
  - Belongs to several societies
  - Share information with others if you know a specific subject that they're interested in
  - Each meeting has a speaker that talks about a specific subject

            - Most meetings of a fairly detailed subject
                - Ex: US stamps from the 1800s
        - Interesting to learn more about the process the speaker went through to gather the information
- Technology
    - App
        - Would use an app that displayed collection, but if you're an enthusiast you want to see the stamps in person
            - Ex: Would you rather watch the Rolling Stones on DVD or go to their live concert?
        - The app would make people aware of what's being held by the museum, but would want to see the actual thing
        - Would be able to highlight items and fine detail on the screen that you would not be able to in a large display without a magnifying glass
    - Online interaction with Philatelists
        - Collecting is so diverse, might get some comments/feedback
        - The interpretation of modern stamps is always changing, so there would be a lot of discussion about those
        - Some stamps or subjects may not be commented on at all because everyone knows what there is to know about the subject
        - Really depends on the subject
        - Also, would be quite the task for a collector to put all of that detail online
        - A lot of collectors don't share knowledge/discoveries, keep it to themselves
            - Information has been lost over the years because of this
            - People of our generation would be more likely to share information
    - Use of technology
        - Home computer
            - Email
            - Don't use internet for publicly sharing information
                - Only share with others that he knows share that particular interest
                - Has one or two friends that do share information publicly
                - If he wants to share findings he publishes an article in a journal or magazine
        - Mobile phone
            - Only used for calls

Appendix M: Notes from Focus Group on Content & Features

4/18/13

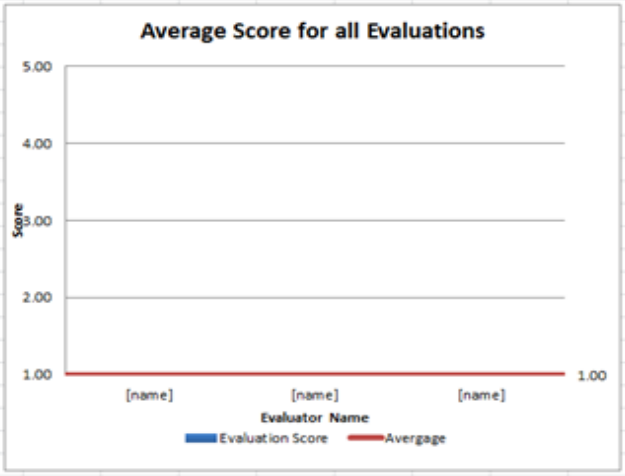
- Very little previous knowledge of stamps, one had collection of stamps from childhood in a storage box at home
    - Given by grandfather on special occasions
    - 8 years of commemorative stamps
    - Would keep them if they're worth anything
        - Pass down to children
- Photographs of stamps
    - Recognized the Machin stamp
        - Used to work for post office – knew what year the stamp was most likely in circulation and what it would be used for
    - Interested in the rarity of the Tyrian Plum stamp
        - Didn't recognize it before we described it, also did not recognize monarch
        - Particularly interested in the value of stamps
        - Sometimes hard to understand why someone would pay so much money for stamps
            - It has to do with the idea of being a collector
    - More interested in examining Freddy Mercury's collection after they knew the collector
        - Like history, where it's been, whose hands they've been in (ex: Freddy Mercury) more than the aesthetic/design of them
- Want to know more about:
    - Social context – what was happening at the time the stamp was produced
    - History of the stamp
    - Volume
    - Rarity
    - Special occasions
    - Interesting frankings, where they've been
    - What could a particular stamp send?
    - What symbols that appear in stamps represent
    - If they were from same era
    - Information to put it in context and place stamps in history
        - Once you embed with context, they're more relatable
            - That's where the pull comes from
            - Otherwise interest in stamps often deemed "geeky"
    - Commonwealth stamps → how stamps shaped postage in other countries
        - Canada, Australia, etc.
        - Would rather view from historical angle first rather than by region
    - Value comparison when it was produced vs. now (this is a "boom factor")
    - Trivia
    - Value
    - "view by" option to sort your taste and pick what interests you on any given day
    - "Wow factor" → stamps are so insignificant, tiny pieces of paper that we use every day, what makes them special? How much will they be worth later?

    - Evolution of artwork, how stamps have evolved through the ages
        - What you put on them
        - Publishing
    - Basic version for visitors, upgrade for collectors
- Wouldn't return to own stamp collection unless found out that something was valuable
    - Personal connection to the stamps, commemorative
    - Represent time in own life
    - What significance did it have in my life?
- Bytelight
    - "Pretty cool"
    - Participants would enjoy
    - Liked the idea of the app
    - Important feature: you should be able to disregard new information that pops up unexpectedly
        - Should not interrupt you if you move to new zone
    - Want the option to go back to content
        - Sometimes finding out something new can make you want to revisit previous information
    - Don't want something else to turn up if they hadn't finished reading yet
    - Irritated if you would have to go back to a zone to look at something again
    - Like trivia and fun facts – appealing feature
    - Comments give the idea that you are manipulating stamps
    - Browse other stamps interesting by subjects
    - Better than reading small panel everyone is clustering around
    - Comfortable to hold device, something that is done daily now
        - Mobile or 7inch iPad
            - Apple and android friendly → more usability
        - Choose not to look at it if you want
        - Good of museums to provide iPads if you can download app as well on your own
            - Would be "a pain" if you can't use your own
        - One for family to explore together
            - Fun facts
            - Sit down for a few minutes, would keep kids involved
            - Would want place to set down iPad if provided by museum
            - Few iPads docked around location, stationary
                - Everyone gets chance to play with it, particularly kids
- Virtual stamp collection
    - Cool, kid friendly
    - Liked image recognition of adding stamps from home to collection more
        - Would be an interesting idea
    - Mobile and tablet friendly would make it more accessible
    - If going to the museum, would download it, but would not otherwise
    - Advertisement of app at museum and the novelty factor would motivate to use the app
        - Curious to see how well it works, if usability is successful

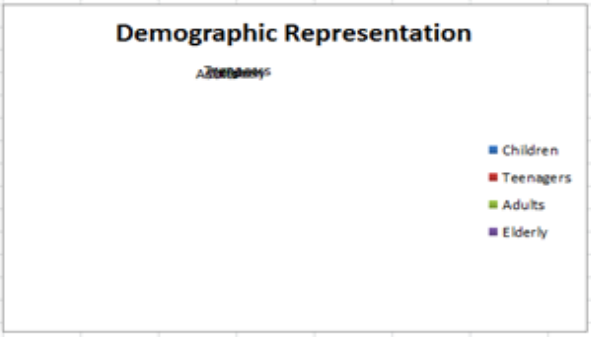
            - Needs to work for curiosity to peak
        - Going to see catalogue after would depend on interest in stamps and success of app
    - If they were interested in stamps they would look at it later
        - Maybe more for kids
    - Involves you in the history or in the subject matter
        - Having some interactivity is what people look for
        - Having own collection, continue after journey to museum
        - Go home and take pictures of other stamps you have already
        - Stamps would work well since they are collectible by nature
- Use of mobile technology
    - Both have smartphones
    - One uses apps more than other → news and Tumblr, not gimmicky apps
        - Doesn't keep them for very long
        - Use apps in bed in the morning to read news
            - Sometimes on commute
                - Not to pass the time, would rather use kindle app and read instead
    - Never knew that museums they visited had apps
        - Speaks volumes for museum advertisements
    - Hate audio guides, spacing out with sound cut out, walking through the museum
        - With an app you can hear what's going on
            - Huge part of the museum experience
            - Engaged visually and tactilely rather than having museum dictate the experience
    - Sometimes use mobile versions of websites, not as good as desktop version often, some content missing
    - If an app became digital collection, would keep it
        - As long as the subject matter was good
        - Interesting content you can revisit
        - Updating in content
        - If you could go straight through to content on mobile site without having to log in again every time (like with Facebook) that would be good
    - Mobile catalogue website, similar to pintrest
        - Wouldn't use site
        - Reason to download is to go to the museum

Appendix N: Sample Graphical Models for Evaluations

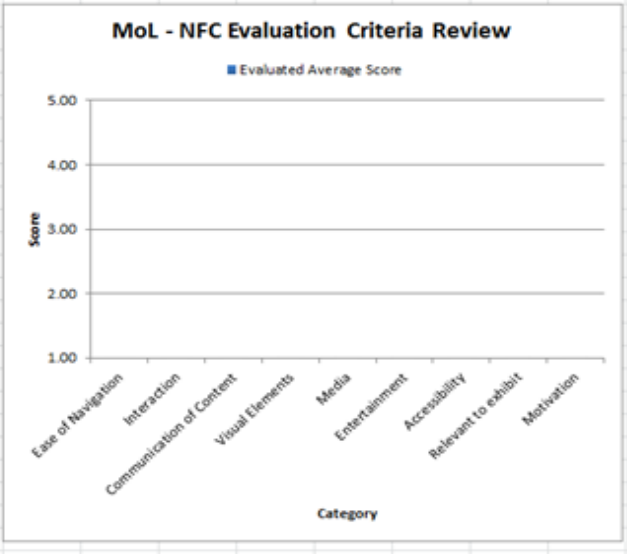
	B	C
2	**App Description**	
4	[description]	
8	**V&A - Exhibit Kiosk Scores**	
9	[name]	1.00
10	[name]	1.00
11	[name]	1.00
12		Avergage
13	0	1.00
14	1	1.00



	B	C
29	**DemoGraphics**	
30	Children	0
31	Teenagers	0
32	Adults	0
33	Elderly	0



	B	C
46	**Category Review**	
47	Ease of Navigation	1.00
48	Interaction	1.00
49	Communication of Content	1.00
50	Visual Elements	1.00
51	Media	1.00
52	Entertainment	1.00
53	Accessibility	1.00
54	Relevant to exhibit	1.00
55	Motivation	1.00
56	Instruction	1.00

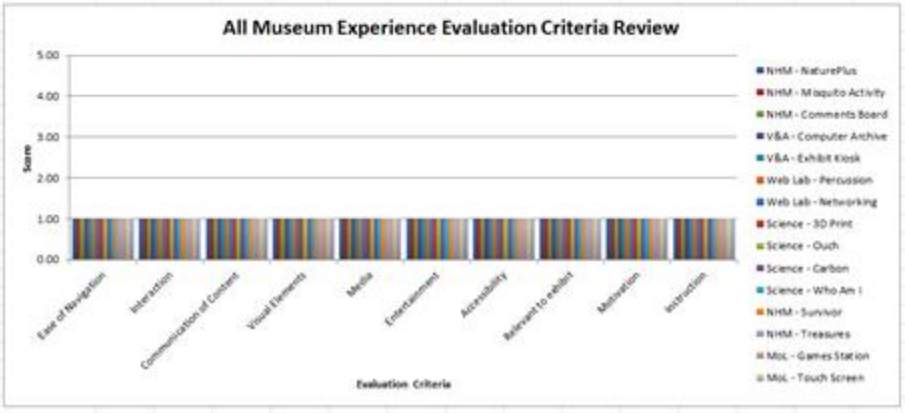


Appendix O: Sample Graphical Models for Recommendations

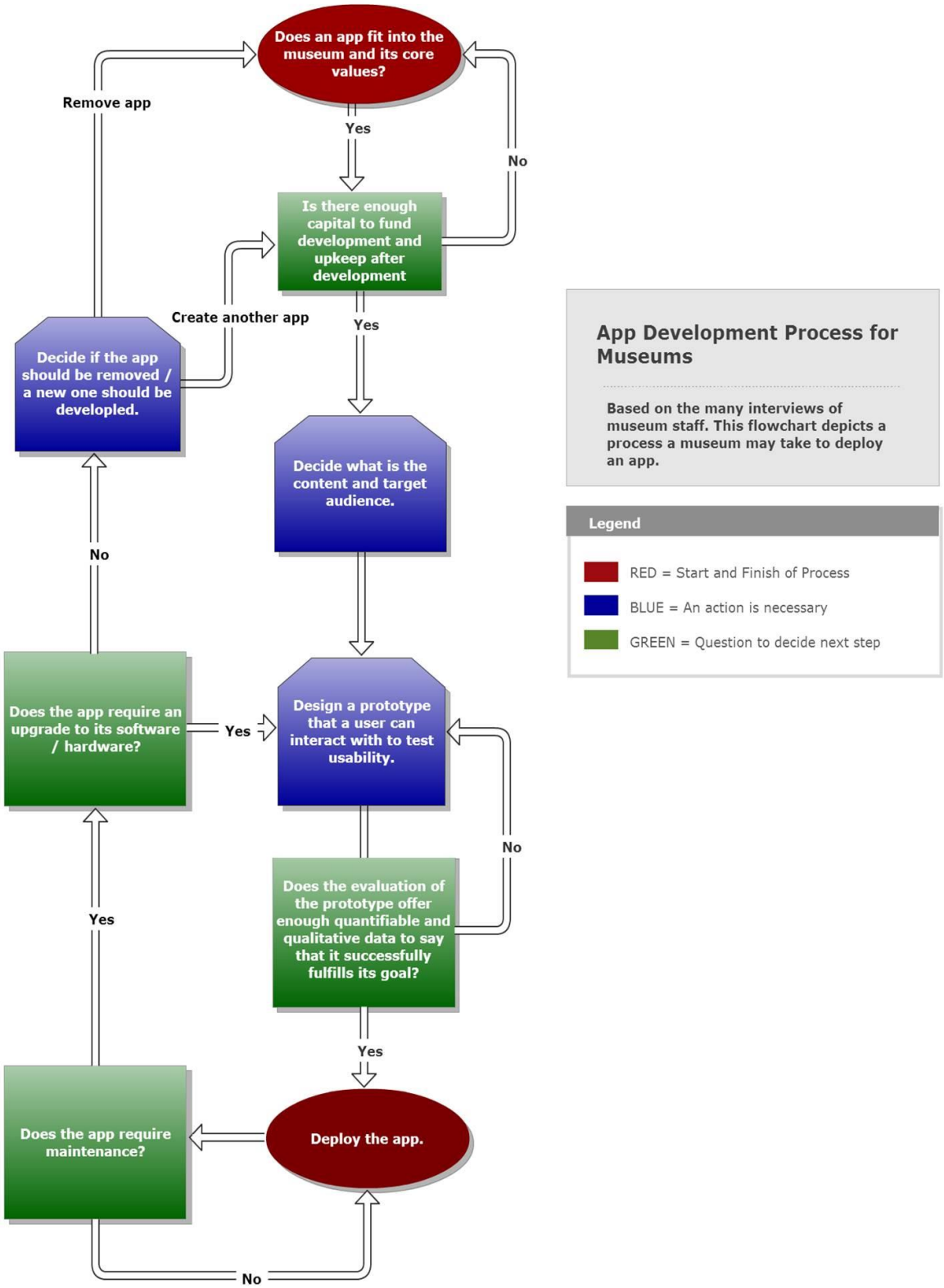
Overall Score	
NHM - NaturePlus	1.00
NHM - Misquito Activity	1.00
NHM - Comments Board	1.00
V&A - Computer Archive	1.00
V&A - Exhibit Kiosk	1.00
Web Lab - Percussion	1.00
Web Lab - Networking	1.00
Science - 3D Print	1.00
Science - Ouch	1.00
Science - Carbon	1.00
Science - Who Am I	1.00
NHM - Survivor	1.00
NHM - Treasures	1.00
MoL - Games Station	1.00
MoL - Touch Screen	1.00
MoL - NFC	1.00

Demographics	NHM - Na	NHM - Mi	NHM - Co	V&A - Co	V&A - Exh	Web Lab -	Web Lab -	Science -	Science -	Science -	Science -	NHM - Su	NHM - Tre	MoL - Gam	MoL - Tou	MoL - NFC
Children	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Teenagers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adults	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Elderly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Category Review	NHM - Na	NHM - Mi	NHM - Co	V&A - Co	V&A - Exh	Web Lab -	Web Lab -	Science -	Science -	Science -	Science -	NHM - Su	NHM - Tre	MoL - Gam	MoL - Tou	MoL - NFC
Ease of Navigation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Interaction	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Communication of Content	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Visual Elements	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Media	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Entertainment	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Accessibility	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Relevant to exhibit	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Motivation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Instruction	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

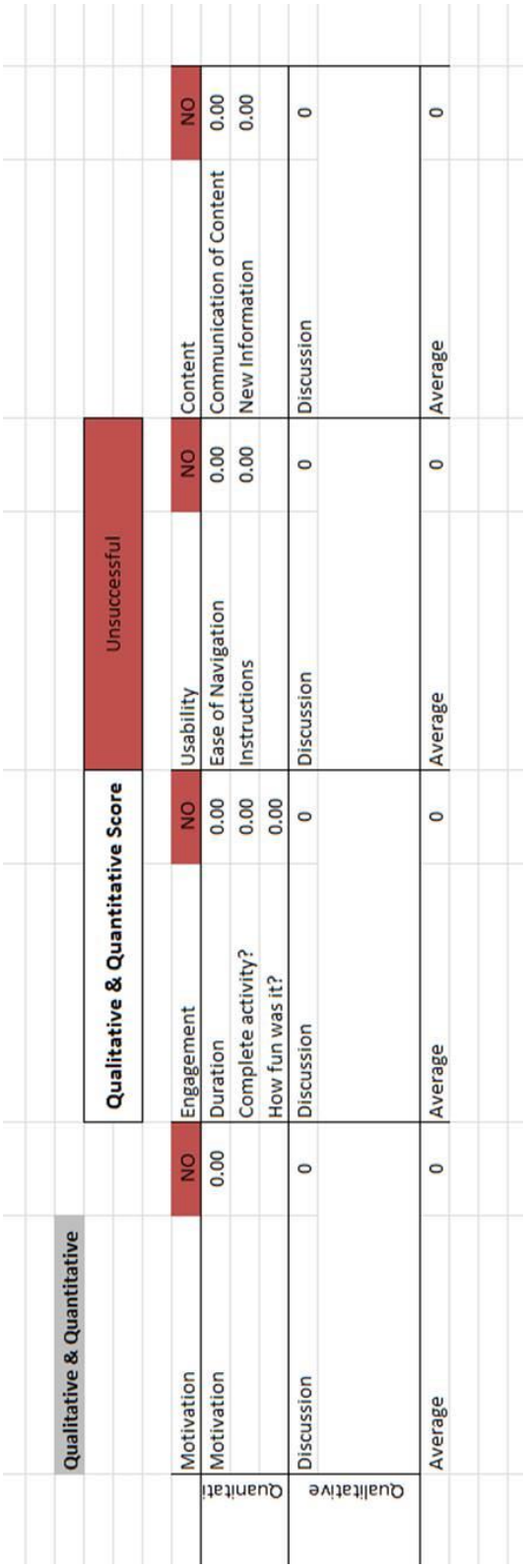


Appendix P: Flowchart for App Development



Appendix Q: Successful Assessment Chart

Must have each of the four categories average a score of 4 to be successful



Qualitative & Quantitative			Qualitative & Quantitative Score		Unsuccessful			
	Motivation	NO	Engagement	NO	Usability	NO	Content	NO
Quantitative	Motivation	0.00	Duration	0.00	Ease of Navigation	0.00	Communication of Content	0.00
			Complete activity?	0.00	Instructions	0.00	New Information	0.00
			How fun was it?	0.00				
Qualitative	Discussion	0	Discussion	0	Discussion	0	Discussion	0
	Average	0	Average	0	Average	0	Average	0

Appendix R: App Evaluation Final Charts

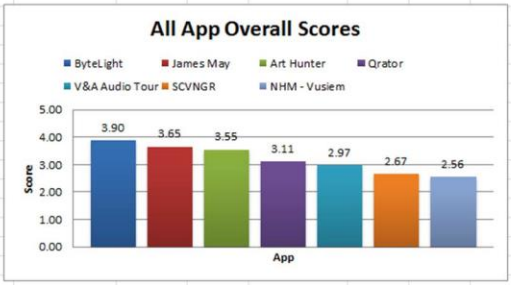
On vs. Off Site

	ByteLight	James Ma	Art Hunte	Qrator	V&A Audio	SCVNGR	NHM - Vusiem
On-Site	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Off-Site	FALSE	TRUE	FALSE	FALSE	FALSE	TRUE	TRUE

Average On-Site Score	3.38
Average Off-Site Score	N/A
Average Both Score	2.96

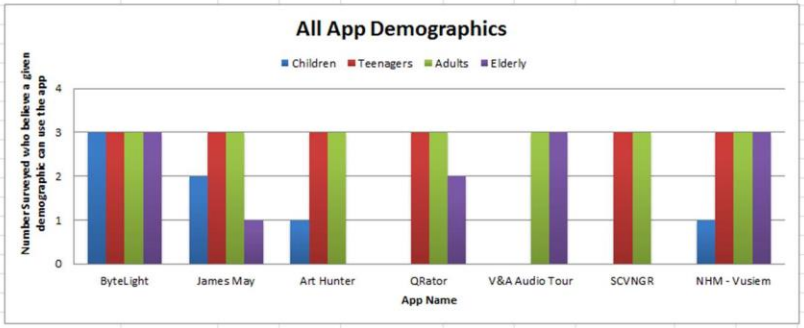
Overall Score

ByteLight	3.90	Successful
James May	3.65	Successful
Art Hunter	3.55	Unsuccessful
Qrator	3.11	Unsuccessful
V&A Audio Tour	2.97	Unsuccessful
SCVNGR	2.67	Unsuccessful
NHM - Vusiem	2.56	Unsuccessful



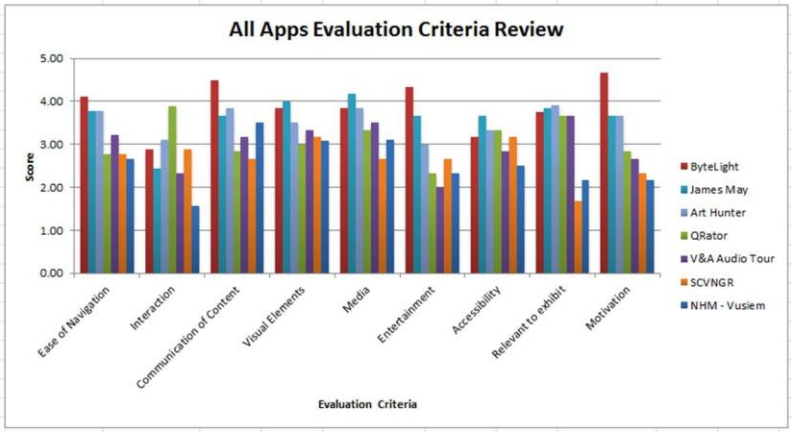
Demographics

	ByteLight	James Ma	Art Hunte	QRator	V&A Audio	SCVNGR	NHM - Vusiem
Children	3	2	1	0	0	0	1
Teenagers	3	3	3	3	0	3	3
Adults	3	3	3	3	3	3	3
Elderly	3	1	0	2	3	0	3



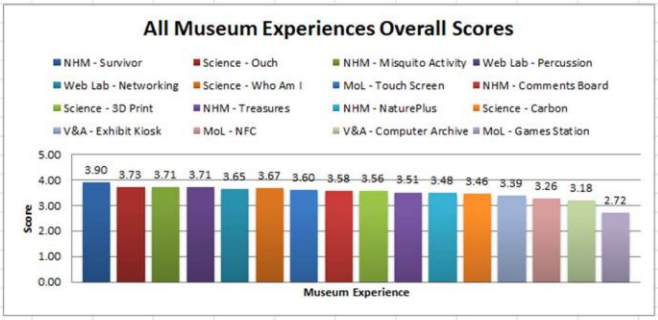
Category Review

	ByteLight	James Ma	Art Hunte	QRator	V&A Audio	SCVNGR	NHM - Vusiem
Ease of Navigation	4.11	3.78	3.78	2.78	3.22	2.78	2.67
Interaction	2.89	2.44	3.11	3.89	2.33	2.89	1.56
Communication of Content	4.50	3.67	3.83	2.83	3.17	2.67	3.50
Visual Elements	3.83	4.00	3.50	3.00	3.33	3.17	3.08
Media	3.83	4.17	3.83	3.33	3.50	2.67	3.11
Entertainment	4.33	3.67	3.00	2.33	2.00	2.67	2.33
Accessibility	3.17	3.67	3.33	3.33	2.83	3.17	2.50
Relevant to exhibit	3.75	3.83	3.92	3.67	3.67	1.67	2.17
Motivation	4.67	3.67	3.67	2.83	2.67	2.33	2.17

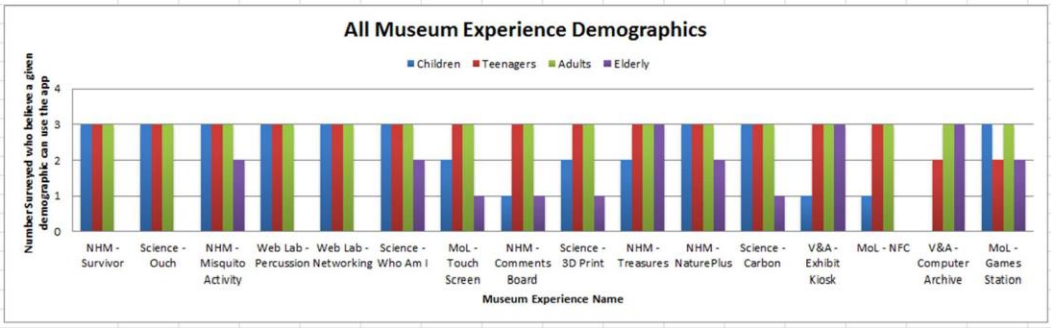


Appendix S: Digital Museum Experience Evaluation Final Charts

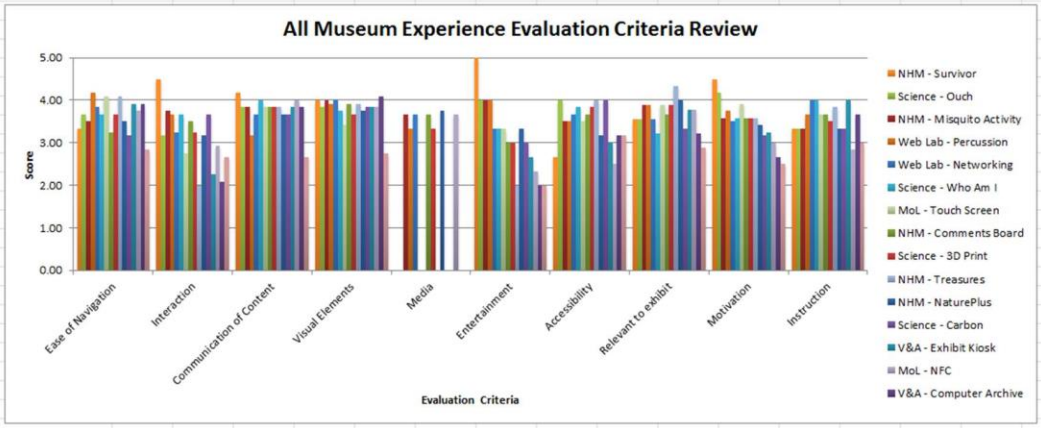
Overall Score		
NHM - Survivor	3.90	Successful
Science - Ouch	3.73	Successful
NHM - Misquito Activity	3.71	Unsuccessful
Web Lab - Percussion	3.71	Unsuccessful
Web Lab - Networking	3.65	Unsuccessful
Science - Who Am I	3.67	Unsuccessful
MoL - Touch Screen	3.60	Successful
NHM - Comments Board	3.58	Unsuccessful
Science - 3D Print	3.56	Unsuccessful
NHM - Treasures	3.51	Unsuccessful
NHM - NaturePlus	3.48	Unsuccessful
Science - Carbon	3.46	Unsuccessful
V&A - Exhibit Kiosk	3.39	Unsuccessful
MoL - NFC	3.26	Unsuccessful
V&A - Computer Archive	3.18	Unsuccessful
MoL - Games Station	2.72	Unsuccessful



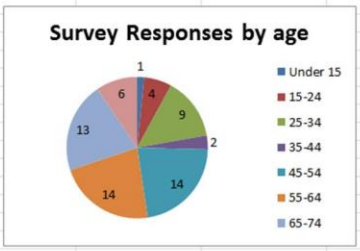
Demographics	NHM - Sur	Science - (	NHM - Mis	Web Lab -	Web Lab -	Science -	MoL - Tou	NHM - Cor	Science - :	NHM - Tre	NHM - Na	Science - (	V&A - Exh	MoL - NFC	V&A - Cor	MoL - Games Station
Children	3	3	3	3	3	3	2	1	2	2	3	3	1	1	0	3
Teenagers	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2
Adults	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Elderly	0	0	2	0	0	2	1	1	1	3	2	1	3	0	3	2

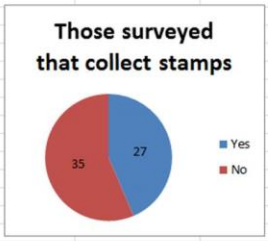


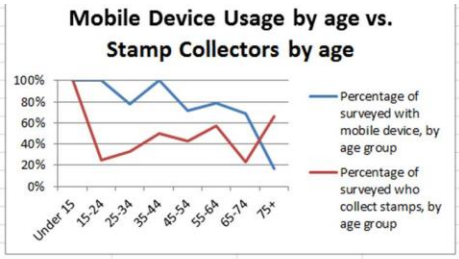
Category Review	NHM - Sur	Science - (	NHM - Mis	Web Lab -	Web Lab -	Science -	MoL - Tou	NHM - Cor	Science - :	NHM - Tre	NHM - Na	Science - (	V&A - Exh	MoL - NFC	V&A - Cor	MoL - Games Station
Ease of Navigation	3.33	3.67	3.50	4.17	3.83	3.67	4.08	3.25	3.67	4.08	3.50	3.17	3.92	3.75	3.92	2.83
Interaction	4.50	3.17	3.75	3.67	3.25	3.67	2.75	3.50	3.25	2.00	3.17	3.67	2.25	2.92	2.08	2.67
Communication of Content	4.17	3.83	3.83	3.17	3.67	4.00	3.83	3.83	3.83	3.83	3.67	3.67	3.83	4.00	3.83	2.67
Visual Elements	4.00	3.83	4.00	3.92	4.00	3.75	3.42	3.92	3.67	3.92	3.75	3.83	3.83	3.83	4.08	2.75
Media	N/A	N/A	3.67	3.33	3.67	N/A	N/A	3.67	3.33	N/A	3.75	N/A	N/A	3.67	N/A	N/A
Entertainment	5.00	4.00	4.00	4.00	3.33	3.33	3.33	3.00	3.00	2.00	3.33	3.00	2.67	2.33	2.00	2.00
Accessibility	2.67	4.00	3.50	3.50	3.67	3.83	3.50	3.67	3.83	4.00	3.17	4.00	3.00	2.50	3.17	3.17
Relevant to exhibit	3.56	3.56	3.89	3.89	3.56	3.22	3.89	3.67	3.89	4.33	4.00	3.33	3.78	3.78	3.22	2.89
Motivation	4.50	4.17	3.58	3.75	3.50	3.58	3.92	3.58	3.58	3.58	3.42	3.17	3.25	3.00	2.67	2.50
Instruction	3.33	3.33	3.33	3.67	4.00	4.00	3.67	3.67	3.50	3.83	3.33	3.33	4.00	2.83	3.67	3.00



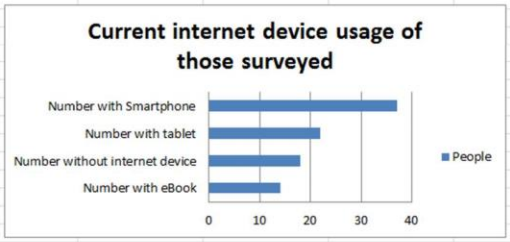
Appendix T: Data from Audience Surveys



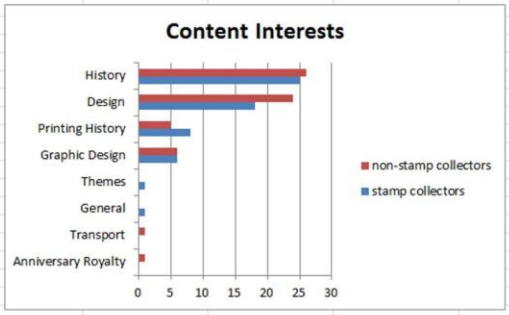




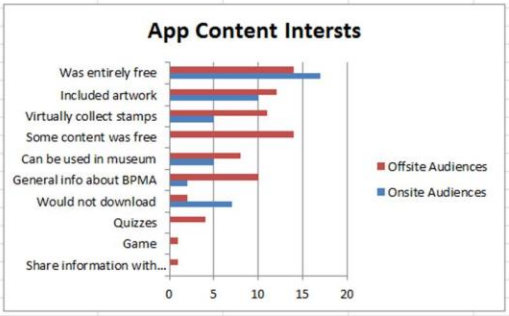
Number with eBook	14
Number without	18
Number with tablet	22
Number with	37



	stamp collectors	non-stamp
Anniversary Royalty		1
Transport		1
General	1	
Themes	1	
Graphic Design	6	6
Printing History	8	5
Design	18	24
History	25	26



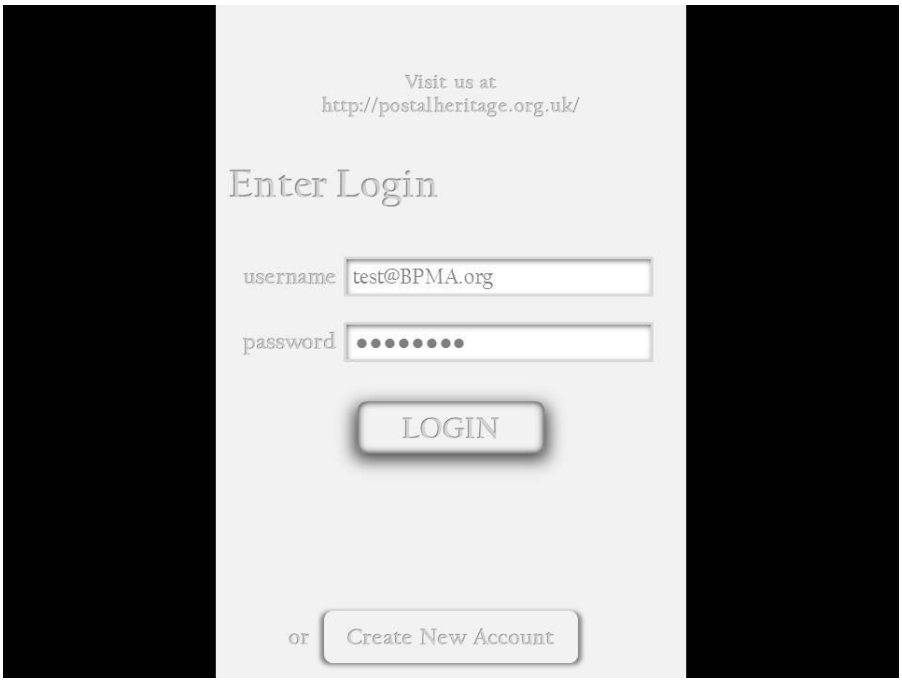
	Onsite Audiences	Offsite Audiences
Share information with	0	1
Game	0	1
Quizzes	0	4
Would not download	7	2
General info about	2	10
Can be used in	5	8
Some content was	0	14
Virtually collect	5	11
Included artwork	10	12
Was entirely free	17	14



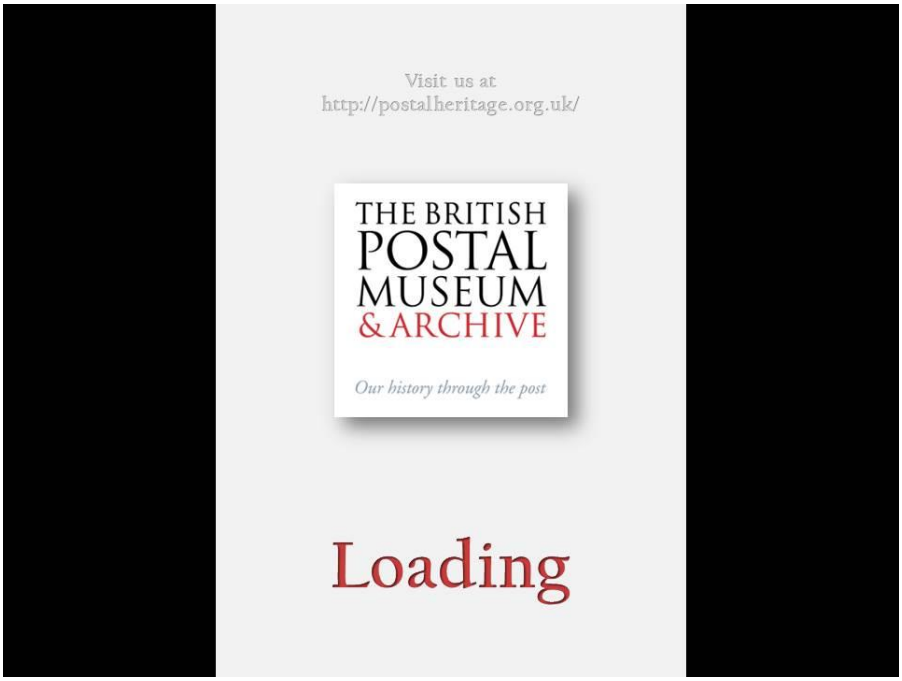
Distribution of Responses

Appendix U: App Prototype & Screenshots

Login Screen



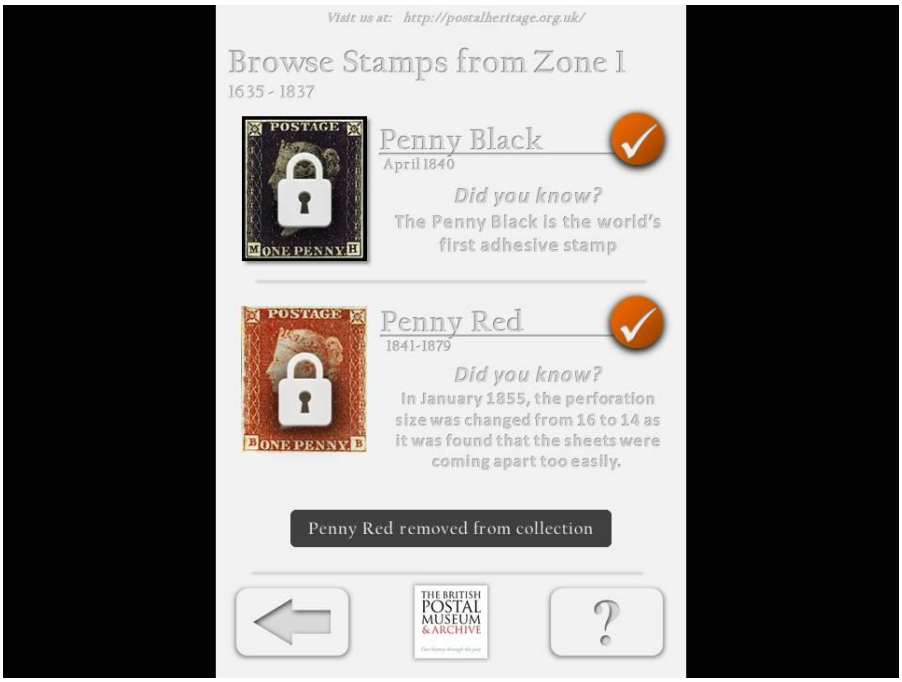
Loading Screen



My Collection – Before Unlocking Content

My Collection – After Unlocking Content from Zone 1

Browsing Locked Stamps – Zone 1

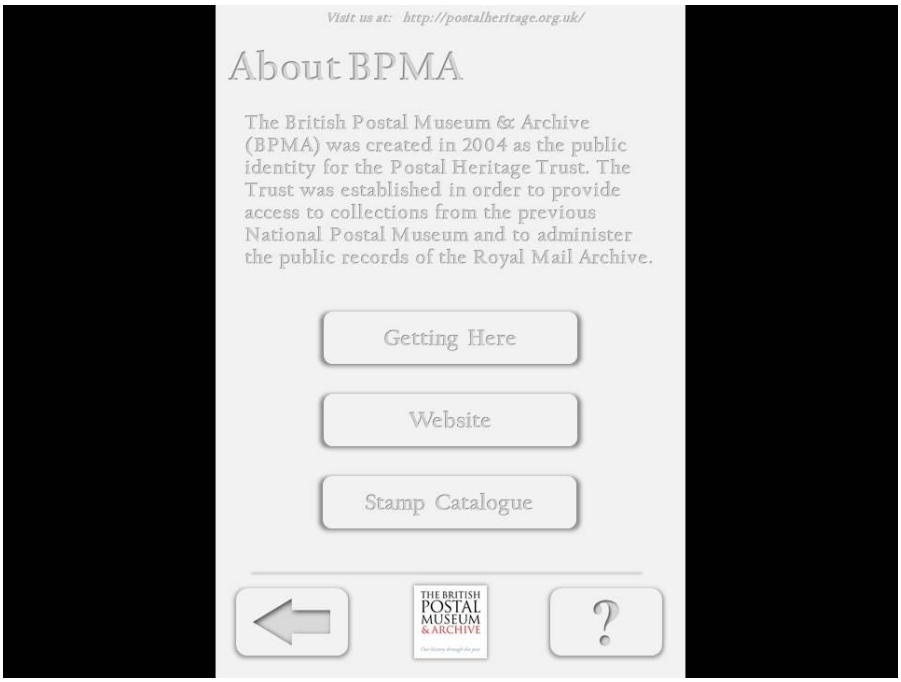


Browsing Locked Stamps – Zone 2

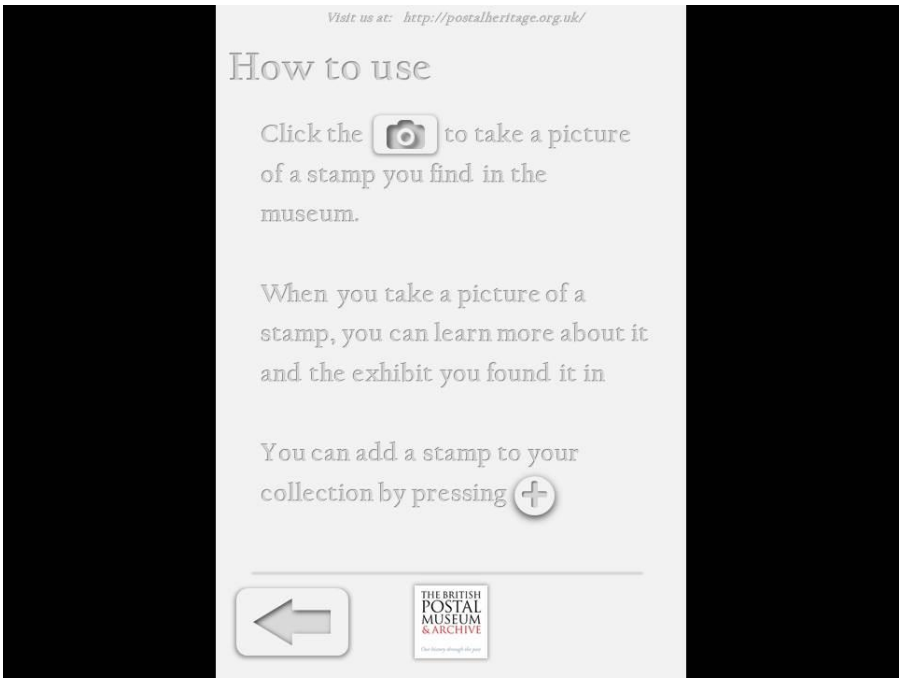
Browsing Locked Stamps – Zone 3

Browsing Unlocked Stamps – Zone 1

About the BPMA

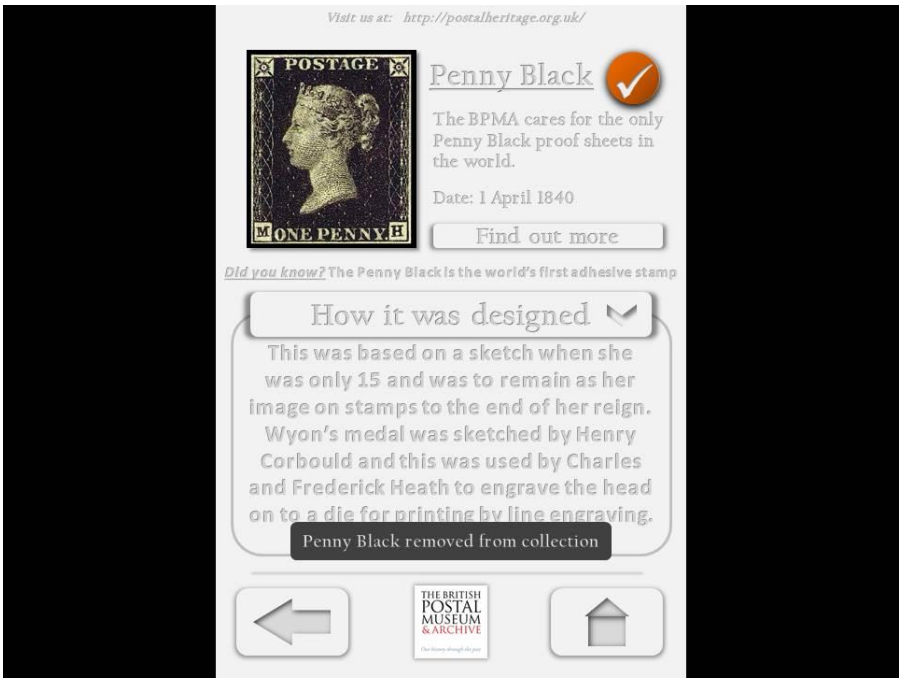


How to Use the App



Taking Photograph of Stamp in Exhibit

Unlocked Stamp Content



High Resolution Image of Unlocked Stamp